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CORRELATION OF CLINICAL TESTS WITH MICROSCOPIC PATHOLOGY OF THE DENTAL PULP[1]

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While a great amount of effort has been devoted to the microscopic study of pulp conditions and a good deal written about pulp testing methods few combined studies have been made. In this study, by correlating clinical tests with microscopic examination of a series of teeth with vital pulps, in various states of health and disease, it is hoped that a more exact evaluation of present diagnostic methods can be made.

Raper states that the electric pulp tester is of great value in determining whether a pulp is vital or necrotic but that crowned teeth, and some teeth with large fillings, cannot be tested; that in a multirooted tooth with part of the pulp vital and part necrotic the reaction is the same as if all were vital; and that it is not practical to attempt to determine any particular pathologic state of a vital pulp with the electric tester. Prinz, on the other hand, states that a normal pulp responds to the faradic current at a specific "irritation point"; hyperemic pulps respond below; acutely inflamed pulps (simple pulpitis) far below; suppurating pulps (acute or chronic suppurative pulpitis) above the normal irritation point; and dead pulps not at all. Mead is in agreement with Prinz. Reiss and Fuerdi, on the other hand, found that pulps that reacted to a normal index (irritation point) included 63.5 percent that were normal and 36.5 pathological; those with moderately high indices, 69 per cent normal and 31 pathological; those with very high indices, 90 per cent pathological. Of the negative responses all were pathological and 87.5 per cent definitely necrotic. Of those that responded severely to a low index, 50 per

[1] Submitted in Partial Fulfillment of the requirements for the Degree of Master of Science in Dental Pathology and Therapeutics in the Graduate School of the University of Illinois, 1934.

cent were inflamed and only 8 per cent normal. One must therefore conclude that degenerated pulps usually responded at high indices and normal pulps at normal indices, but the reactions among the different groups overlap considerably. A negative reaction always indicated pathology, and nearly always necrosis, but a positive reaction did not indicate a normal pulp with any certainty.

Cahn has observed perseverance of nerves in totally degenerated areas of the pulp, and pointed out that such a pulp would respond to electrical stimuli. Since the electric test produces sensation in the pulp by direct stimulation of nerve fibers, it is obvious that so long as the nerves of the pulp are vital, little can be told about the rest of the pulp tissue by this means. Thoma does not consider the electric tester of value in diagnosing pulp infection, but states that the roentgenogram is the most reliable means of diagnosis. He admits the necessity of taking several roentgenograms at various angles, and believes it possible to demonstrate in the roentgenogram of almost every infected vital pulp an etiological factor, such as deep primary or secondary caries, or secondary changes, such as an extension of the inflammation into the periapical tissue, or both.

METHODS

The clinical data recorded were: age and sex of patient; history of the tooth symptoms and operations; clinical condition of the crown; radiographic appearance; response of the tooth to heat, cold, and electricity and responses to the same agencies of adjacent or similar teeth. In the history, it was determined whether the tooth ever had been sensitive to heat, cold, or sweets, had ached without previous stimulation, had been painful when percussed, when subjected to pressure or during mastication, and whether the tooth had been filled. The importance of the history was to ascertain, if possible, whether the circulation of the pulp ever had been injured, and if so had it returned to normal quickly; since Black has observed that, in general, the more severe the paroxysms of pain in a pulp, the greater the dilatation of the blood vessels. In recording clinical condition of the crown, the presence and extent of caries, abrasion, erosion and fillings were observed. Obvious exposure of the pulp was recorded, but in deep caries no attempt was made to remove carious dentin.

Recession of the gingivae and the presence of pockets were also recorded. The radiographs were used chiefly to observe how closely caries or fillings approached the pulp, how much secondary dentin was formed, and whether the apical peridental membrane seemed involved.

To determine response to heat, a piece of gutta percha was heated in pliers until it began to smoke and then lightly applied to the labial or buccal surface of the tooth. If there was no immediate painful response, the gutta percha was reapplied for about five seconds. If the tooth again did not respond this was recorded as negative. Otherwise the intensity and duration of the pain and the number of seconds the gutta percha was applied to the tooth, were recorded. This test provided an indication of any loss of ability of the blood vessels to contract after artificially induced dilatation. Some teeth were tested similarly with a hot burnisher, but this method was limited to anterior teeth and bicuspids; molars seldom responded.

To determine the response to cold, ice was held against the crown on buccal or labial surface or, with second and third molars, on the occlusal surface, and kept there for at least ten seconds or until a painful response was elicited. The cold water was absorbed with a cotton roll to prevent chilling of adjacent teeth. The severity and duration of the pain and the time required for response were recorded.

Various makes of electrical pulp testers were tried to determine their accuracy. With a double tooth electrode, if the tooth was too dry or too wet, the strongest stimulus gave no response, while the same tooth with proper moisture might respond to the least stimulus. The electrical resistance of a dry tooth surface was so high that sufficient current did not flow into the tooth while excessive moisture short-circuited the current with the same result. This great variation in resistance to, and penetration of, current made it difficult to find a uniform threshold of tooth stimulation. Combination of a hand- and a tooth-electrode proved more uniform. Variations in resistance caused by different grips on the hand electrode were found to make no appreciable difference, providing that the electrode was held in some manner in the hand. However, all pulp tests recorded were made with the patient firmly gripping the electrode. The

variations in resistance caused by different methods of application of the tooth electrode were found to be appreciable. When the tip of the tooth electrode was wrapped lightly with moistened cotton, it was found that the different amounts of moisture caused a variation in the test of as much as twenty points. The amount of tooth surface in contact with the electrode also determined a variation of from ten to twenty points; the greater the area of tooth covered, the less was the amount of current required to produce a response. However, the greatest variation in current depended upon differences in surfaces of the tooth. Pits, fissures, abraded areas, carious areas and fillings all gave responses to relatively lower currents than intact enamel. For this reason the tooth electrode was applied to sound enamel on the labial and buccal surfaces. The crowns of the teeth tested were thoroughly dried to prevent variation due to moisture. By this means the reaction indices could be kept fairly uniform, generally within a range of 10 points on a 50-point scale. When any other tooth surface was used, this was recorded so that due allowance might be made for variation. In some instances several types of tests were made to evaluate different methods.

The teeth, obtained largely in clinic patients, were mostly all radiographed and tested with ice, hot gutta percha, and electricity except for the inaccessible third molars and teeth with gold crowns which were not tested electrically. The history and symptoms were recorded in every instance. The teeth were extracted under local anesthesia and immediately placed in 10 percent formalin. Some were cracked in a vise, and in others a hole was drilled into the pulp chamber, to insure more rapid fixation and to aid penetration of celloidin. Celloidin embedding was used in all but one case where frozen sections were used. In one other case a few frozen sections were made before embedding. Serial sections, 12 to 16 microns thick, were stained with hematoxylin and eosin, and Mallory's triple connective tissue stain. Diagnosis of pulp conditions was made microscopically from these sections, and compared with clinical history and the results of pulp tests.

DATA

Sectioned Teeth. The results with 37 teeth are listed in Table I. The *normal pulp* may show a few signs of degeneration, such as slight vacuolization of the odontoblastic

layer, secondary dentin, or pulp calcification; but it appears as a normal tissue, and contains no signs of inflammation. It is significant that in the normal pulp none of the symptoms or tests suggest abnormality, except the electric tests, which varied considerably but nevertheless gave a response in each case. Pulps listed under *moderate atrophy and degeneration* microscopically showed noticeable degenerative changes, such as considerable vacuolization of odontoblasts and fibroid or calcific degeneration. However, all of these pulps contained some normal tissue and in none were there any signs of inflammation. As in the normal pulps there were no symptoms of disease, but two failed to respond to heat and one of these failed to respond to cold or electricity. This tooth, which failed to respond to all three tests radiographically showed obliteration of most of the pulp chamber by secondary dentin (*fig. 1*). Pulps listed under *marked atrophy and degeneration* microscopically showed degenerative changes such that little remaining pulp tissue was normal, including reticular atrophy, fibroid, hyalin and calcific degeneration, and vacuolization and atrophy of the odontoblasts. These pulps showed no evidence of inflammation, and responded to tests essentially as did the moderately degenerated pulps. The fact that most of these pulps responded normally to all tests and manifested no painful symptoms substantiates the finding of Prinz, and others, that regressive or degenerative conditions of the pulp cannot be diagnosed clinically by present testing methods.

Each of two teeth listed under *acute simple pulpitis* microscopically contained one small area of polymorphonuclear infiltration but no large abscesses and both were just slightly exposed by caries. They had been intermittently painful for one and two weeks. In one, heat induced severe pain lasting six seconds, cold a severe pain that did not last, and the electrical index was high. The other, an upper third molar, was tested only with cold, which immediately induced a severe pain that did not last. Radiographically the periapical tissue appeared normal. Six teeth listed under *acute suppurative pulpitis*, all contained large pulp abscesses with polymorphonuclear infiltration and vascular engorgement in the inflamed areas. Caries had exposed the pulp in four and was deep in another, while the sixth had an intact crown. All had been sensitive to heat and cold and had given intermittent pain for several days or weeks. Four had ached so as to prevent sleep the night before they were extracted, and two were tender on palpation. In the tooth with intact crown there was dense interstitial calcification (*fig. 2*) and fibroid degeneration, with several pulp abscesses. The pain in this instance had been reflex, extending to temporal region and ear. To the heat test of these teeth two responded normally, one very quickly, and three with very severe pain. To cold, one gave a normal response and five gave severe responses, in three with lasting pain. To the electric test five gave average responses; the sixth was not tested. All six showed normal periapical tissue radiographically.

Two teeth with *chronic pulpitis*, both clinically exposed, had only slight symptoms but gave a severe sharp pain when food was impacted into the pulp chamber during mastication. Both were painful to exploration. One failed to respond to cold, but gave a severe response to a low electric current. There was a slight periapical thickening in one, seen radiographically. Both pulps had been exposed by dental operations several months previously to relieve acute pain.

In an additional tooth, an upper molar in which the pulp was acutely inflamed, the tissue in the disto-buccal canal was necrotic, and the rest of the pulp hyperemic (*fig. 3*). This pulp was exposed by caries; it had been sensitive to heat and cold for several weeks and had been very painful the previous night. Heat produced a severe pain which lasted several minutes, cold a severe pain which lasted half a minute; the electric response was average.

TABLE I

Results on 37 teeth tested clinically and examined microscopically

MICROSCOPIC DIAGNOSIS	NUMBER OF CASES	SYMPTOMS	HEAT		COLD		ELECTRICITY		RADIOGRAPHIC DIAGNOSIS	
			Number tested	Response	Number tested	Response	Number tested	Index	Tooth	Apex
Normal (slight degenerative changes)	5	None	4	4 average	4	3 average 1 delayed	4	1 average 2 mod. high 1 very high	Negative	Negative
Moderate atrophy and degeneration	8	None	7	5 average 2 negative	6	4 average 1 delayed 1 negative	7	4 average 1 mod. high 1 high 1 negative	Sec. dentin in 1	Negative
Marked atrophy and degeneration	7	None	7	4 average 1 slow, severe 2 negative	6	4 average 2 slow	6	4 average 1 mod. high 1 negative	Sec. dentin	Negative
Acute simple pulpitis	2	Intermittent pain, 1–2 weeks	2	2 severe, lasting	2	2 severe	1	High	Deep caries in 1	Negative in 1
Acute suppurative pulpitis	6	Sensitive to heat, cold; intermittent pain, etc.	6	2 average 1 quick 3 very severe	6	1 average 5 severe 3 lasting	5	5 average	Deep caries in 5 Intact in 1	Negative

Chronic pulpitis	2	Pulps exposed, pain only on food impaction		—	2	2 negative	1	Very low	Pulps exposed	Slight thickening of peridental membrane
Gangrene, half vital, half necrotic	1	Pulp exposed, very sensitive to heat and cold; pain, 1 week	1	Severe, lasting 2 min.	1	Severe, lasting ½ min.	1	Average		—
Edema	2	1 tender, 1 painful to sweets	1	Ached, relieved by cold	2	2 average	2	1 average 1 very low		—
Hyperemia, pulp nodules	1	Sensitive to heat, cold; vague pain to ear		—		—		—	Deep caries	Negative
Hyperemia, partial thrombosis	1	Filling out; severe throbbing pain 2 days		—		—		—	Deep recurrent caries	Negative
Acute parodontitis	2	Tender, sensitive to heat, throbbing	2	1 severe 1 positive		—		—	Negative	Negative

Two teeth with *hyperemic pulps and intact crowns*, which had been subjected to occlusal trauma were both very tender and had ached severely the night before with throbbing pain. Extraction relieved the pain. One of these responded severely to heat. Electrical tests and cold tests several months before extraction had given average responses. Radiographically the teeth appeared normal. Microscopically the pulps showed some engorged blood vessels and one area of old hemorrhage, but were otherwise essentially

TABLE II

Results on 6 teeth tested clinically but not examined microscopically

SYMPTOMS	HEAT REACTION	COLD REACTION	ELECTRICITY INDEX	RADIOGRAPHIC DIAGNOSIS	DIAGNOSIS ON OPENING PULP CHAMBER
Intermittent pain until 4 days before; tender but not sensitive to heat and cold since	Negative	Negative	Very high	——	Gangrenous pulp
Severe pain for one week; started by heat, stopped by cold; pain ceased night before	Negative	Negative	High	——	Gangrenous pulp
Throbbing pain last two days (tender); relieved by opening chamber	Negative	Negative	——	——	Total suppurative pulpitis (blood and pus)
Tender, face swollen; dull pain on side; flow of pus from pulp canal	Negative	Negative	Very low	Periapically normal	Necrotic pulp, acute apical abscess
Broken crown, pain after fracture; no pain last month or since (not exposed)	Negative	Negative	Negative	Periapically normal	Caseation necrosis of pulp
Sensitive to heat and cold for one year; caries to roof of pulp chamber	Normal	Severe	Average	Thickened apical peridental membrane; deep caries	Exposed vital pulp (Chronic pulpitis)

normal. Two instances of *hyperemia in carious teeth* were studied. One had been sensitive to heat and cold. Microscopically some vessels were engorged with erythrocytes, and there were two large pulp nodules. The other tooth had an old deep filling, had ached for two days, had throbbed at night, and microscopically showed deep caries but no pulp exposure. There were no inflammatory cells, but one large artery was engorged with red cells. This tooth did not respond to cold, and radiographically showed a deep filling with normal periapical tissue. Of two teeth with *edema* of the pulp, one was tender, and gave a lasting pain to the heat test which was relieved by cold. Both responded

normally to the cold test. One responded at a very low index to the electric tester and the other at an average index. There were no signs of inflammation microscopically but both contained large vacuoles.

Clinical Cases. Table II shows the results in six cases in which the diagnosis was made clinically. In five the pulps were destroyed; none of these responded to cold or heat, but three responded to electric current, one did not respond and one was not tested. In the two listed as gangrenous pulps the history of severe pain which stopped suddenly is an important diagnostic point. The response to a very low electric current in the sixth case, of acute apical abscess, indicates the hyperirritability of inflamed tissue and shows that a pulp canal filled with liquid necrotic material is a good conductor of electric current.

CONCLUSIONS

From the foregoing study the following conclusions are indicated: 1. The *normal* pulp is without painful symptoms, gives an average response to hot and cold stimuli, gives a response to the electric tester at a variable index, and radiographically shows no periapical changes. 2. The *atrophied and degenerated* pulp is without painful symptoms, generally gives an average response to electric, hot and cold stimuli but may give a variable or no response, and radiographically shows no periapical change, although it may show secondary calcification in the pulp canal. This indicates that degenerative changes cannot be reliably diagnosed clinically. 3. The *acutely inflamed* pulp gives painful symptoms, may give average reactions to heat and cold, but generally gives a severely painful response which lasts longer than the normal reaction. To electrical stimuli the response is generally average but it may vary. Generally deep caries is discernible, both clinically and radiographically, but the crown may be intact. The periapical tissue is normal radiographically. 4. The *chronically inflamed* pulp generally gives no severe symptoms. It is usually exposed by caries. Food forced into the cavity may produce a painful shock. Radiographically the periapical tissue may or may not show involvement. Too few cases of chronic pulpitis were studied to give any weight to this conclusion but in general it agrees with previous investigations. 5. *Vascular* changes produce painful symptoms which may vary considerably. Not enough cases of uncomplicated vascular change were studied to justify a sound conclusion. The consensus of opinion of previous writers has been that hyperemia produces increased sensitivity to stimuli, and that in general the severity of the response indicates the degree of hyperemia. 6. The *necrotic* pulp gives no response to

heat and cold tests, but if the contents of the canal are liquid it may give a response to the electric test.

REFERENCES TO LITERATURE

BLACK, G. V., Special Dental Pathology, Medico-Dental Publishing Co. Chicago, 1915.

BURCHARD AND INGLIS, Dental Pathology and Therapeutics. Lea and Febiger, Philadelphia, 1912.

CAHN, L. R., *Den. Items Interest*, 48: 1, 1926

Ibid, idem., 49: 598, 1927.

Ibid, idem., 49: 860, 1927.

COOLIDGE, E. D., *J. Amer. Den. A.*, November, 1932.

FISH, E. W., *Brit. Den. J.*, 53: 351, 1932.

HATTON, E. H., *J. Amer. Den. A.*, 17: 2262, 1930.

HILL, T., *J. Amer. Den. A.*, 21: 820, 1934.

HOPEWELL-SMITH, *Den. Items Interest*, 47: 477, 557, 1925.

KRONFELD, R., Histopathology of the Teeth. Lea and Febiger, Phila., 1933.

MEAD, S. V., Diseases of the Mouth, C. V. Mosby Co., St. Louis, 1932, p. 86.

PRINZ, H., Diseases of the Soft Structures of the Teeth and Their Treatment. Lea and Febiger, Phila., 1928.

RAPER, H. R., Electro-Radiographic Diagnosis. C. V. Mosby Co., St. Louis, 1921.

REISS, AND FUERDI, *Den. Cosmos*, 75: 272, 1933.

THOMA, K., *Den. Items Interest*, 47: 637, 1925.

THOMA, K., *J. Den. Res.*, 9: 447, 1929.

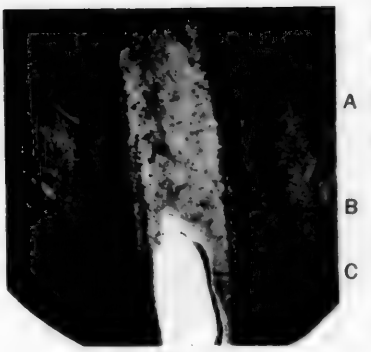

Fig. 1

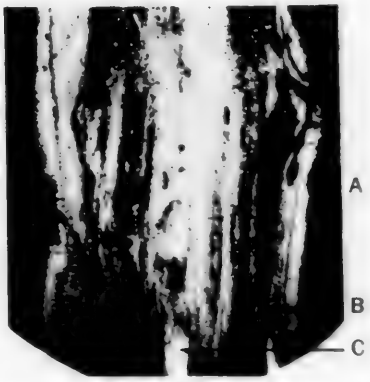

Fig. 2

Fig. 1. A, primary dentin; B, secondary dentin; C, pulp (fibroid degeneration). Case failed to respond to heat or electric test, but gave delayed response to ice. (Listed under *moderate atrophy and degeneration* in Table 1). Almost half of pulp canal is obliterated by secondary dentin, visible radiographically.

Fig. 2. A, dentin; B, interstitial calcification; C, dilated blood vessel. Tooth (upper first molar) had hurt for two months; pain extended to ear and temporal region. It was very tender, but crown was intact. Peridental pocket 5 mm. deep extended around tooth. The response to electric test was at average index, but both heat and cold produced severe lasting pain. There were many pulpal abscesses, which accounted for pain. Cases with similar interstitial calcifications but without inflammation produced no such symptoms.

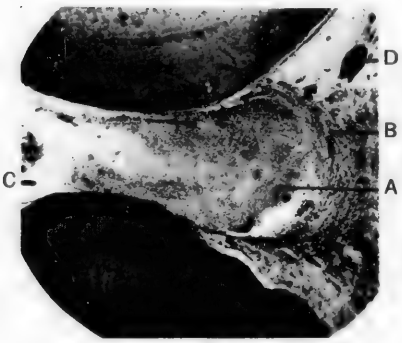

Fig. 3

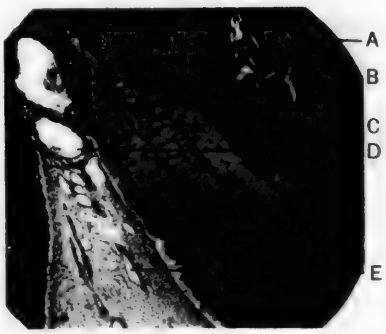

Fig. 4

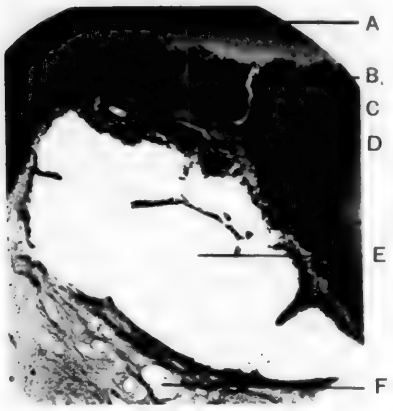

Fig. 5

Fig. 3. A, small round cell infiltration; B, fibrous tissue; C, necrotic area; D, laminated pulp nodule. Tooth (upper second molar) had been sensitive to heat and cold and had ached for one week. It responded to average electrical index. One canal contained necrotic pulp tissue, others vital pulp tissue. Both heat and cold tests produced severe, lasting pain.

Fig. 4. A, carious primary dentin; B, necrotic tissue in pulp horn; C, carious secondary dentin; D, pulp abscess; E, dilated blood vessel. Pulp (lower third molar) was normal except for area of inflammation shown in pulp horn. It had been intermittently painful for one week, and had been sensitive to heat and cold. It responded at moderately high electric index, gave severe response to cold, and severe and lasting response to heat.

Fig. 5. A, cavity; B, carious primary dentin; C, carious secondary dentin; D, dense polymorphonuclear leukocyte infiltration; E, abscess cavity; F, dilated blood vessels. Tooth had deep cavity, had ached for one week with very severe throbbing pain night before extraction. Electric test was slightly below average, and both heat and cold produced severe pain, cold the more severe.

CHEMICAL ANALYSIS OF TOOTH SAMPLES COMPOSED OF ENAMEL, DENTINE AND CEMENTUM. II.[1]

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The data in Table I are a progress report in a chemical study of normal values for the chemical composition of human teeth. Average values for moisture, inorganic content, Ca, P, CO_2 and "residue solution-number" are given for about 100[3] teeth. The preliminary procedure in the examination of deciduous and permanent teeth, including preparation of the tooth, determination of moist, dry, and inorganic weights, and residue solution-number, was that of Crowell, Hodge, and Line (6). Where samples weighed less than 250 mg., standard micromethods have been used for determinations of Ca (4), P (8), and CO_2 (16). Teeth large enough to afford samples for gravimetric analysis, either for single or duplicate determinations, have been analyzed according to the methods of Washburn and Shear (19).

To check the reliability of gravimetric methods for Ca and P, two large samples of tooth inorganic-substance were prepared, mixed t' oroughly and portions sent to several laboratories for analysis. The results (Table II) indicate a satisfactory agreement (with one exception) and illustrate the maximum procedure accuracy (about 0.1 percent). To compare the precisions of the micro- and macromethods employed for Ca and P, eleven samples were analyzed by both methods (Table III). The average differences are no greater than the reported method errors.

[1] The data in this paper are taken from a thesis submitted by Marian L. LeFevre in partial fulfillment of the requirements for the degree of Master of Science, at the University of Rochester.

[2] Rockefeller Senior Fellow in Dentistry.

[3] Values for 15 teeth of patient W. B. reported elsewhere (14), are included in the averages and also in Tables III and IV.

TABLE I

Analytical data

PATIENT	TOOTH NO.	TOOTH	MOISTURE	INORG.	Ca	P	Ca:P (%)	CO_2	RESIDUE SOLUTION NO.
			per cent	*per cent*	*per cent*	*per cent*		*per cent*	
E. B.	101	$\overline{6}\vert$	10.7	80.5	34.9	16.9	2.06		12.8
	102	$\vert\overline{e}$	11.5	81.2	35.0	16.7	2.10		11.3
	103	$\overline{d}\vert$	9.64	85.7	34.6	16.6	2.08	3.65	13.3
	104	$\overline{e}\vert$	11.8	80.2	35.0	16.8	2.08		15.6*
	105	$\vert\overline{d}$	10.5	85.9	34.7	16.6	2.09		12.9
	106	$\vert\overline{d}$	12.8	81.7	35.4	17.0	2.08		13.1
	107	$\vert\overline{e}$	12.3		35.2	16.5	2.13		13.1
	109	$\overline{c}\vert$	9.35	83.3	34.9	16.7	2.09		
	110	$\overline{e}\vert$	11.4	85.7	35.2	16.6	2.12	3.25	12.4
	111	$\vert\overline{6}$	10.8	82.0	35.0	17.0	2.06	3.74	12.6
	112	$\vert\overline{c}$	10.2	84.7	34.1	16.7	2.04		12.9
V. A.	113	$\vert\overline{7}$	7.96	85.0	34.1	16.8	2.03		12.8
	114	$\vert\overline{6}$	7.89	84.4	35.3	16.8	2.10	3.44	12.8
	115	$\vert\overline{5}$	6.70	83.8	34.7	16.8	2.06		12.4
	122	$\overline{7}\vert$	8.26	88.7	35.6	16.8	2.12	3.28	13.7
	123	$\overline{6}\vert$	8.55	85.7	34.7	17.4	1.99*	3.42	13.3
	124	$\overline{5}\vert$	8.14	88.4	34.0	16.6	2.05	2.99	13.2
S. G.	120	$\vert\overline{6}$	10.3	85.6	35.2	16.6	2.12	3.29	11.6
	121	$\vert\overline{5}$	7.72	84.8	35.7	16.9	2.11		12.5
M. J.	134	$\overline{6}\vert$	11.2	85.0	36.3	17.3	2.10		11.5
	150	$\vert\overline{1}$	6.58	86.9	36.2	17.2	2.10	3.10	12.6
W. M.	116	$\overline{3}\vert$	9.82	79.7	34.4	16.6	2.07		12.3
	117	$\overline{5}\vert$	8.08	84.8	35.5	16.8	2.11	3.51	12.3
	118	$\overline{4}\vert$	9.44	82.8	35.0	16.7	2.10		11.7
	119	$\overline{6}\vert$	9.77	81.0	35.2	16.7	2.10	3.57	13.0
	131	$\vert\overline{4}$	7.54	85.8	35.4	16.8	2.11	3.07	14.0
	132	$\vert\overline{3}$	9.66	82.7	34.3	16.5	2.08	3.64	13.2
	133	$\vert\overline{2}$	9.89	82.2	34.2	16.3	2.10	3.97	14.4*
	145	$\vert\overline{1}$	9.09	82.9	35.1	16.9	2.08	3.27	13.4
	146	$\overline{1}\vert$	8.88	82.5	34.9	16.8	2.08		12.0
	147	$\overline{2}\vert$	9.13	83.3	36.8	16.9	2.18		13.8
	148	$\vert\overline{2}$	8.92	82.8	35.8	16.9	2.12		12.2
	149	$\vert\overline{3}$	10.2	81.7	36.5	17.3	2.11		12.6

* Values discarded on the basis of standard deviation. The underlined values were determined with micromethods. The term "moisture" is here used advisedly in preference to "water" since it is recognized that part of the water content of the tooth substance is held as "water of crystallization" or "water of constitution" and is not driven off at 100°C. (Gabriel, 1894). The moisture is expressed as percentage of moist weight, the inorganic as percentage of dry weight, and the inorganic constituents as percentage of inorganic weight.

TABLE I—*Continued*

PATIENT	TOOTH NO.	TOOTH	MOISTURE	INORG.	Ca	P	Ca:P (%)	CO_2	RESIDUE SOLUTION NO.
			per cent	*per cent*	*per cent*	*per cent*		*per cent*	
H. L.	160	8|	7.23	90.1	35.7	16.9	2.11		12.6
	161	7|	8.27	86.8	35.9	17.0	2.11	3.26	12.6
	162	5|	5.80	89.4	35.2	16.8	2.09		11.9
	165	1|	7.24	87.8	36.2	17.2	2.10		12.1
	166	|8	8.28	89.3	36.2	17.2	2.10	3.50	12.9
	167	|7	8.02	89.6	36.2	17.1	2.11		12.2
	168	|5	7.08	91.8*	36.4	16.8	2.16		13.0
	169	|3	11.2	83.2	36.5	16.5	2.21*		12.6
	170	|2	7.26	88.4	35.2	16.9	2.08		13.0
	171	|1	6.18	86.3	36.2	17.2	2.10	3.36	12.2
H. M.	172	7|	8.58	84.8	35.8	17.0	2.10	3.47	12.9
	173	5|	6.00	85.3	36.0	17.2	2.09	3.39	11.7
	174	4|	6.48	84.7	34.7	16.9	2.05		12.9
	175	3|	9.20	82.6	35.6	17.1	2.08	3.63	12.5
	176	2|	8.53	82.0	34.9	16.5	2.11		12.4
	177	1|	5.63	88.2	35.2	16.9	2.08		12.6
	178	|1	9.48	81.2	34.0	16.3	2.08		12.2
	179	|2	7.15	84.0	34.5	16.6	2.08		13.0
	180	|3	9.06	83.4	35.7	16.9	2.11		11.4
	181	|4	6.52	87.7	34.5	16.7	2.07		11.8
	182	|5	8.32	86.6	36.2	17.2	2.10	3.35	12.5
	183	|6	11.3	84.0	35.4	16.8	2.10	3.51	13.1
	184	|8	8.67	87.5	35.6	17.1	2.08	3.55	13.4
	185	|7	9.63	85.3	35.7	17.0	2.10	3.57	11.7
	186	|5	9.98	84.8	35.9	17.2	2.09	3.24	11.7
	187	|4	9.35	86.5	36.1	17.2	2.10	3.27	13.4
	188	|3	10.6	86.4	36.1	17.3	2.09		13.0
A. M.	125	5|	10.7	81.8	34.6	16.4	2.11	3.63	12.7
	126	3|	10.0	84.1	35.0	16.6	2.11		12.9
	127	|3	12.5	80.5	34.2	16.4	2.09		11.7
	128	|5	10.7	82.2	34.9	16.6	2.10		12.9
	129	|6	9.07	84.8	35.4	16.7	2.12	3.66	12.3
	130	7|	9.14	84.3	35.5	16.9	2.10	3.25	12.9
M. B.	189	8|	10.5	89.2	36.2	17.2	2.10	3.24	13.1
	190	6|	10.5	88.3	35.7	17.1	2.09		12.5
	191	5|	9.25	89.2	36.0	17.4	2.07	3.28	13.0
	192	4|	9.32	87.0	35.8	17.3	2.07	3.43	12.9
	193	3|	9.02	86.8	35.9	17.1	2.10	3.27	12.9
	194	2|	7.48	86.8	35.6	16.6	2.14		12.7
	195	1|	7.18	86.4	35.6	16.6	2.14		12.3
	196	7|	8.32	87.2	35.8	17.2	2.08		12.6
	197	5|	8.37	87.4	36.1	17.2	2.10		12.3

TABLE I—*Concluded*

PATIENT	TOOTH NO.	TOOTH	MOISTURE	INORG.	Ca	P	Ca:P (%)	CO_3	RESIDUE SOLUTION NO.
			per cent	*per cent*	*per cent*	*per cent*		*per cent*	
M. B.—	198	$\underline{4}\vert$	9.08	83.8	35.7	17.2	2.08	3.68	12.2
Concluded	199	$\underline{2}\vert$	8.12	85.5	35.2	16.6	2.12	3.25	12.5
	200	$\underline{1}\vert$	8.60	86.5	35.8	17.2	2.08	3.01	12.0
	201	$\vert\underline{1}$	9.38	86.4	34.5	16.4	2.10	3.01	12.3
	202	$\vert\underline{2}$	8.98	86.3	34.8	16.1	2.16	3.09	12.5
	203	$\vert\overline{1}$	8.93	84.2	34.5	16.0	2.15	3.19	12.8
	204	$\vert\overline{2}$	6.38	88.3	34.8	16.5	2.11	3.17	12.7
	205	$\vert\overline{3}$	7.42	86.8	34.1	16.1	2.12	3.32	12.2
	206	$\vert\overline{5}$	8.35	84.8	34.6	16.1	2.15	3.26	12.6
	211	$\vert\underline{3}$	13.2	82.0	35.0	16.6	2.11	3.69	12.9

Teeth of adults show wide limits of variation in moisture content; namely, from 4.58 to 13.8, average—8.98; in CO_2 content, from 2.99 to 4.03, average—3.45. The limits of variation for residue solution-number and inorganic residue are relatively narrower, being from 11.3 to 14.0, average—12.6, and 78.7 to 90.1, average—84.8, respectively. The values for Ca, P, and hence the Ca:P percent ratio, are relatively constant, Ca ranging from 33.6 to 36.8, average—35.2; P, from 16.0 to 17.4, average—16.8; and the ratio from 2.02 to 2.18, average—2.10. Briefly, the data may be represented as the average percentage, plus or minus the standard deviation as follows: moisture, 8.98 $\pm$ 2.23; inorganic residue, 84.8 $\pm$ 2.56; Ca, 35.2 $\pm$ 0.76; P, 16.8 $\pm$ 0.36; Ca:P percent ratio, 2.10 $\pm$ 0.03; CO_2, 3.45 $\pm$ 0.26; and the residue solution number, 12.6 $\pm$ 0.63.

On the whole, the principle indication from the data is the often quoted "remarkable constancy" of composition of tooth substance. However, since methods of precision have been used in this study certain variations in the values, which would be meaningless if derived from less accurate procedures, should be noted. These variations may be due to variations in the tooth itself (*a*) in type (morphological), (*b*) kind (deciduous or permanent), or (*c*) condition (sound or carious); or to variations in the individual from whom the tooth was extracted, such as age, sex, or oral health. When the values for the various constituents were plotted against the tooth type (morphological) no consistent relations were obtained. When such graphs

were made from the data for a single individual, some random distributions of values were found; also some distributions of sufficient regularity to be designated as patterns (14). Two types of patterns were discovered: *type 1*—parallelism between different constituents in the same teeth, between the same constituents on the two sides of the same jaw, or between upper and lower jaws; *type 2*—asymmetry in the same fashions. Examples of type 1 are found in the Ca and

TABLE II

Comparison of analytical values on two composite tooth samples as given by several laboratories

SAMPLE	LABORATORY	CALCIUM	PHOSPHORUS	Ca:P (%)	PRECISION
		per cent	*per cent*		*per cent*
Y	A	35.2 35.2	16.6 16.6	2.12	0.3
"	B	34.66 34.61	15.04 15.06	2.30	not known
"	LeF. and H.	35.99 35.75 35.95 35.88	17.02 17.02 17.06 17.06	2.11	0.3
Z	B	33.74 33.79	14.91 14.93	2.26	not known
"	C	35.13	16.47	2.13	0.3
"	D	35.98	16.71	2.153	0.1
"	LeF. and H.	35.62 35.68 35.67	17.01 16.93 16.96	2.10	0.3

P values for patient H. M.; of type 2, in these values for patient M. B. Since neither of these last types of variation in tooth composition has previously been described, we hesitate to do more than point out the need for further analyses of teeth from so-called "full mouth extractions."

Other investigators have reported that deciduous teeth, in comparison with permanent, have more moisture, less Ca and P (15, 9),

and the carbonate (15), although one investigator found that deciduous teeth have a lower CO_2 content than permanent teeth (9). In this investigation, deciduous teeth were found to have more moisture; less inorganic residue, Ca, and P; and about the same residue solution-number and CO_2 content (Table IV). The higher moisture content of deciduous teeth is entirely in line with the general consideration that every tissue has a higher water content when young.

Certain investigators have found that sound teeth, in comparison with carious, have more Ca (1, 5, 10, 17), less P (11), and less Mg

TABLE III

Comparison of gravimetric and micro methods for calcium and phosphorus

SAMPLE TOOTH NO.	CALCIUM			PHOSPHORUS		
	Grav.	Micro	Diff.	Grav.	Micro	Diff.
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
86	34.8	34.5	0.9	16.5	16.1	2.4
87	34.5	34.2	0.9	16.5	16.5	0.0
88	33.6	34.4	2.3	16.3	16.4	0.6
89	34.9	34.7	0.6	16.7	16.1	3.6
90	34.8	33.6	3.5	16.6	16.2	2.4
91	34.5*	34.0	1.5	16.2	16.1	0.6
92	35.0	33.9	3.1	16.5*	17.0	3.0
93	35.6	34.4	3.4	16.8	16.5	1.8
94	35.7	34.5	3.4	16.7	16.2	3.0
99	34.5	34.2	0.9	16.6	16.9	1.8
100	34.5	33.4	3.1	16.6	16.4	1.2

* All values with the exception of those marked with asterisks represent averages of duplicate determinations.

(11, 17); while other investigators find no difference in Ca (7), water, ash, and volatile matter (3). We find (Table IV) little difference in the inorganic constituents of sound and carious teeth, excepting moisture content, where the mean value for the carious is higher than for the sound (compare 6). The teeth chosen as carious are those having cavities; in many much of the carious part of the tooth had been removed during operative dental procedures so that the so-called "carious" tooth included "sound" tooth substance. Accordingly, higher moisture content of carious teeth may be better interpreted as a factor in higher predisposition to caries than as an effect of the carious process upon tooth tissues.

Next, considering variations in the values attributable to possible differences in the patients, the values are grouped on three bases:

TABLE IV

Adult teeth: according to various groupings

GROUP	MOISTURE	INORG.	Ca	P	Ca:P (%)	CO_2	RESIDUE SOLUTION NO.
	per cent	*per cent*	*per cent*	*per cent*		*per cent*	
General mean	8.98	84.8	35.2	16.8	2.10	3.43	12.6
	(98)	(98)	(99)	(98)	(97)	(53)	(94)
Standard deviation	2.2	2.6	0.8	0.4	0.03	0.26	0.63
Permanent	8.83	85.0	35.2	16.8	2.10	3.43	12.7
	(89)	(90)	(90)	(89)	(88)	(51)	(87)
Deciduous	11.1	83.6	34.9	16.7	2.09	3.45	12.7
	(9)	(8)	(9)	(9)	(9)	(2)	(7)
Sound	8.71	84.7	35.1	16.8	2.10	3.44	12.6
	(42)	(44)	(43)	(42)	(43)	(21)	(39)
Carious	9.18	85.0	35.3	16.8	2.10	3.43	12.6
	(56)	(54)	(56)	(56)	(54)	(32)	(55)
Age 10–20	11.0	83.1	34.9	16.7	2.08	3.55	12.7
	(11)	(10)	(11)	(11)	(11)	(3)	(9)
Age 20–30	8.55	85.1	35.6	16.9	2.11	3.44	12.6
	(24)	(23)	(24)	(24)	(23)	(10)	(23)
Age 40–50	8.79	85.0	35.2	16.8	2.10	3.42	12.6
	(63)	(65)	(64)	(63)	(63)	(40)	(62)
Male	8.96	83.9	35.2	16.8	2.10	3.53	12.6
	(50)	(52)	(51)	(50)	(51)	(28)	(48)
Female	8.40	86.7	35.5	16.9	2.10	3.29	12.6
	(37)	(36)	(37)	(37)	(35)	(22)	(37)
Moderate alveolar atrophy	8.62	84.9	35.2	16.8	2.10	3.54	12.6
	(46)	(47)	(47)	(46)	(46)	(24)	(45)
Advanced alveolar atrophy	8.84	85.2	35.5	16.8	2.10	3.32	12.7
	(41)	(41)	(41)	(41)	(40)	(26)	(40)

Moisture is expressed as percentage of moist weight; inorganic, as percentage of dry weight; inorganic constituents, as percentage of inorganic weight.

The number of values represented by the averages are contained in the parentheses.

age, sex, and oral health (specifically, degree of alveolar atrophy). From Table IV it is apparent that there are few average differences

in the teeth when grouped according to age. The average differences between the teeth of the two age groups, 10–20 and 20–30, in moisture, inorganic residue, and Ca, can be attributed to the fact that nine out of the eleven teeth in the 10–20 group are deciduous. The difference between carbonate contents of these groups—3.55 and 3.44, respectively—is not characteristic of differences between deciduous and permanent teeth, but agrees with Lassaigne's (13) finding of a greater percentage of CO_2 for the teeth of a six-year-old child than for an adult. Reports in the literature (3, 12, 7, 2, 6) show little difference between teeth in organic matter, water, Ca, and P, when grouped according to age. The teeth from males and females showed little difference in chemical composition (Table IV), in agreement with a number of earlier investigators (18, 3, 7, 6). When the teeth are grouped according to severity of the alveolar disturbance in the patient's mouth (Table IV), the only striking difference is that in carbonate contents, which apparently decreased with increasing severity of the disease.

SUMMARY

(1) Average values for chemical composition of about 100 teeth of adults follow: Moisture, 8.98 ± 2.23; inorganic residue, 84.8 ± 2.56; Ca, 35.2 ± 0.76; P, 16.8 ± 0.36; Ca:P percent ratio, 2.10 ± 0.03; CO_2, 3.45 ± 0.26; residue solution number, 12.6 ± 0.63. (2) The principal characteristic of the data is the "remarkable constancy" of composition of tooth substance. (3) "Patterns" are obtained in some cases when certain values for the teeth from a single individual are plotted against tooth type. (4) Deciduous teeth have more moisture, less inorganic residue, Ca and P, and about the same carbonate content and "residue solution-number" as permanent teeth. (5) There is little difference, except in moisture content, between carious and sound teeth. (6) There is little evidence of changes due to age in the chemical constitution of teeth. (7) There is little chemical difference between teeth from male and from female patients. (8) With increasing severity of pyorrhea, there may be a decrease in carbonate content of the teeth.

REFERENCES TO LITERATURE

(1) Bergamini, M., *La Stomatologie, 28:* 484, 1930 [see (6) Table p. 253].
(2) Bernardi, A., *Ann. chim. applicata, 18:* 454, 1928.
(3) Black, G. V., *Den. Cosmos, 37:* 353, 1895.
(4) Clark, E. P., and Collip, J. B., *J. Biol. Chem., 63:* 461, 1925.
(5) Cohn, C., Über den Einfluss der Caries auf die chemische Zusammensetzung des Zahnbeins; Inaug. Diss., Bern, 1889.
(6) Crowell, C. D., Hodge, H. C., Line, W. R., *J. Den. Res., 14:* 251, 1934.
(7) Fish, E. W., An experimental investigation of enamel, dentine, and the dentinal pulp; John Bale, Sons and Danielsson, Ltd., London, 1932.
(8) Fiske, C. H., and Subbarrow, Y., *J. Biol. Chem., 66:* 375, 1925.
(9) Gassmann, T., *Z. physiol. Chem., 55:* 455, 1908.
(10) Kaushansky, L. I., *Den. Cosmos, 72:* 758, 1930.
(11) Kaushansky, L. I., *Ibid., 74:* 468, 1932.
(12) Kühns, C., *Deu. Monats. Zhk., 13:* 450, 1895.
(13) Lassaigne, quoted by Von Bibra (18) p. 279.
(14) LeFevre, M. L., and Hodge, H. C., *Den. Cosmos, 78:* 1119, 1936.
(15) Pepys, quoted by Fox, J., "The natural history and diseases of human teeth," *2nd ed.*; Cox and Son, London, 1814.
(16) Shear, M. J., and Kramer, B., *J. Biol. Chem., 79:* 105, 1928.
(17) Ulrich, J. L., *Den. Cosmos, 67:* 1204, 1925.
(18) Von Bibra, Chemische Untersuchungen über die Knochen und Zähne des Menschen, p. 262 et seq.; Schweinfurt, Kunstverlag, 1844.
(19) Washburn, M. L., and Shear, M. J., *J. Biol. Chem., 99:* 21, 1932.

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Lord Baltimore Hotel, Baltimore, Maryland
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Compiled by WILLIAM J. GIES, F.A.C.D., *Secretary*[2]

Columbia University, New York City

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[1] The sessions of the Research Association preceded, by agreement, those of the Fourteenth Annual Meeting of the American Association of Dental Schools, in the same hotel, March 15–17. The members of each body were welcome at, and participated in, the sessions of both associations. The chairmen were the President, Dr. William G. Skillen, Northwestern University, and the President-elect, Dr. Paul C. Kitchin, Ohio State University. The annual informal dinner, served to members and guests on the evening of March 14 preceding the concluding session, was attended by 132 persons. [The President's address, abstracts of papers, and data of executive proceedings, etc., *at the general meeting in 1936*, were published in the *J. Den. Res.*, *15:* 295–382, 1936.]

[2] Most of the abstracts have been prepared by those who presented the corresponding papers. All editorial abbreviations have been verified by the authors.

I. Address of Retiring President*

William G. Skillen, D.D.S., Dental School, Northwestern University, Chicago, Ill.

In art, in music, in literature and especially in the sciences, the great teachers are little known to the public while the names of some of their pupils have become household words. I have often wondered why this is so. The preceptor has rarely appeared in the limelight, but talented or inspired pupils who have absorbed his wisdom and applied it practically have been widely acclaimed. A few of you who perhaps have read the Bible are familiar with the fact that St. Paul "sat at the feet of Gamaliel" and absorbed his wisdom. Everybody knows of St. Paul but possibly few hold any reverence for Gamaliel.

The great teacher gives freely from the storehouse of his knowledge, which he has quietly but with infinite labor acquired, the facts which enable some scintillant mind in the group he is addressing to follow new thought-paths, with the result that the pupil may work out something startlingly novel and find himself more honored by men than is his teacher. It seems to me sometimes that teachers might very well be likened to the little spring rivulets which gather the moisture from the mountain tops. They feed the larger streams; and some of those streams may ultimately develop into an intellectual Mississippi, sweeping everything before it until it is finally lost in the great ocean of accepted facts.

Someone has spoken of endocrinology as a "towering structure in the sunshine." If one refers to a history of medicine, he immediately becomes impressed with the tremendous influence that Claude Bernard had in the development of this once embryonic science. From Saint Julien, the district in the vine-clad hills of France which produces the famous (but thin) claret, this poor but promising son of an obscure vintner went to Paris in the early part of the nineteenth century to find a producer for a five-act tragedy which he had written, having already had some success with a comic vaudeville skit. Fortunately for him and science, the critic whom he consulted saw

* This and the two succeeding addresses were delivered after the annual dinner at the sixth session (March 14), before the concluding executive proceedings (page 332).

another future than that of a playwright for this tall, earnest chap and persuaded him to take up the study of medicine.

At first things didn't go so well with him, for the paralysing hand of "recognized authority" was, if possible, even more potent than it is today. Claude was an original thinker, a trail blazer, who apparently was always in trouble with his teachers—just as many students are today over the question "Why"—until he met Magendie, who set his feet upon the path he was to follow with such distinction. And what a path it was! And how sincerely he walked it, with all of him, sacrificing upon the altar of his goddess, Truth, many things that other men hold most dear.

Dumas spoke of him as the essence of physiology itself. Pasteur gave him the highest praise. Napoleon was so charmed by his engaging personality that he made him a senator. So, in doing honor to some of the brilliant workers in endocrinology, we cannot deny this indefatigable scholar his just acclaim. But suppose for a moment that he had not met Magendie! Is it not conceivable that "the towering structure of endocrinology" might still be only a two-or-three story building?

One gets the impression that but little praise is Magendie's lot. One must look rather far to find a likeness of him. But reading of this relationship, I couldn't help wondering exactly to whom rightfully belongs the title of founder. Magendie was certainly something of a research worker, although it is said that he was constantly groping in the dark, experimenting haphazardly. Perhaps this was because he was, by nature, a teacher; perhaps just preparing unknown ground. Are men of great motive power ever the best teachers? The imperative type that would bend all minds to match its own may build bridges, erect tunnels, capture cities, but not necessarily teach. In the presence of such a personality, spontaneity tends to droop and thought to slink away. To give yourself in a way that will inspire others to think, to do, to become—that would seem to me to be the true essence of teaching. To be a good teacher demands a high degree of altruism, for one must be willing to sink self in order that others may rise to the point of being able to do without him. Had Claude Bernard not come into the hands of this great teacher—for one can hardly speak of him as other than that—is it

not possible that his name might never have gone down in the history of medicine?

Bernard was a builder who never deviated from the path indicated for him. Magendie divined this, and was great enough to recognize that here was one who was better equipped to carry on with the building of the structure with which he had been fumbling; and he was generous enough, when the time came, to proclaim that his pupil was a better man than himself.

The other day, as I stood looking at one of our magnificent skyscrapers with all of its cornices and other embellishments, the thought occurred to me that the fellows who sink the caissons and lay the foundations may get a kick out of their work but they certainly are short on glory. The structural steel-workers, out where folks can see their deeds of courage, are celebrated in conversation and press. The fellow who lays the cornerstone gets his picture in the papers, and the architects and financiers are given tiresome banquets, but after the building has reached completion, who cares about or even bothers to give a thought to the mud diggers who labored and sweated underground so that all of the superstructure might have legs on which to stand? It's a far cry from Vesalius to Crile, but the latter could have done none of the wonderful restorative work upon the human structure that he has accomplished had it not been for Vesalius' untiring and intelligent investigation in dingy quarters on very stinking cadavers. These structures which have arisen and which man sees, admires and lauds, must of necessity be erected upon a firm foundation of facts and known measurements or they will soon topple to the ground.

In relinquishing my office as president, I should like to leave one thought with all of you. Most of us in this group are both teachers and research workers. It is highly improbable that the work of any of us will go down on record as in any way comparable to the work of either of the men about whom I have been speaking. Yet, in another sense, our work is just as important. If we maintain the true spirit of teaching, endeavoring to suggest, inspire, encourage, and to convey to others with sympathy and understanding, the knowledge and experience we have gathered that they may carry

on in the field of dentistry, then we are playing rôles just as important as those of greater teachers who have gone before us. If we, as research men, work with intelligent and purposeful direction of thought and action—at the correlation of facts that we may find new meanings for the benefit of others—then we are doing a very important bit toward the furthering of dental science. But let us not forget that both types of work are essential, although adeptness at one may not necessarily mean adeptness at the other, and that perhaps describes Magendie.

At times it has seemed to me that too much attention and pressure have been brought to bear upon research and not enough on teaching. By all means, let us investigate and search for new footholds upon the frontiers of science and publish the results for the benefit of all. But in our eagerness and haste for progress and recognition, let us not be satisfied with surmise. Let us not run the danger of becoming, as someone so aptly put it recently, a "paper mill"—sacrificing our high ideals by turning out work that has not been subject to rigid verification—to cater to any foolish whims and tendencies. Whether or not our digging and caisson laying are ever highly applauded, may any foundations that we build be steadfast and unyielding.

In closing, I wish to express my appreciation of all that the Baltimore group has done to make this meeting the success it has been. I am totally unable to express my appreciation of all Dr. Aisenberg, especially, has done for me personally and for you—this meeting could never have functioned as well without him. I want also to thank Dr. Gies for his usual wholehearted coöperation and his tolerance of my ineptitude. I could not bring to an end these pleasant duties without paying due respect, also, to the Committees on Publication and Endowment of the *Journal of Dental Research*, for their sincere, devoted, and highly successful efforts against great odds. The work of each committee deserves hearty commendation and support. In the same terms, I wish to express appreciation of the efforts of many others in the endeavor to make a cumulative success of our most important adjunct, the *Journal*.

Gentlemen, it has been a sincere pleasure to serve you and I hope I haven't let you down too greatly. However, it is with no small

feeling of relief but with extreme happiness that I now turn over this honor to a "little big man,"—a better man, if you please—my good friend Kitchin. Happy landings, Paul!

II. Introduction of President-elect

George C. Paffenbarger, D.D.S., F.A.C.D., Research Associate, American Dental Association; National Bureau of Standards, Washington, D. C.

As a Turkish horseman was wending his way across a desert trail, he came upon a traveler footsore and weary. Taking compassion upon the footman, the horseman invited him to mount and ride with him to the next village. In their conversation, it was revealed that both were strangers in this section of the land. Using this information as his cue, the footsore traveler, cunning and ungracious rascal that he was, hatched this diabolical scheme: Said he to his host, when they were on the outskirts of the village, "You are not known here; neither am I. These people do not know whether this horse is yours or mine. I am going to claim it and, amid the clamor of our claims, I may be taken as the owner and then I will ride off with your horse." The ensuing fight caused a crowd to collect and as both contestants shouted liar and thief at each other, the mob dragged them off to the Caliph, who asked each man to tell his story. They told almost identical stories. Each had been riding on a horse, each had offered hospitality and each was being robbed of almost his sole fortune—his horse. The Caliph questioned neither, but ordered them both to prison. In three days he issued a command for their return and stated that he was ready to pronounce judgment, but that if the guilty one would now confess, the penalty would be light. Both the thief and his host stoutly maintained their innocence. Then the Caliph turned toward the owner of the horse and said: "I have unjustly delayed you and imprisoned you. Name the penalty which you wish this thief to suffer." "Not now, most learned Caliph," returned the owner of the horse: "Take him away for I must talk with you."

After the prisoner was taken away, the horseman said: "O, most wise master, tell me how you knew, tell me what wisdom you have that enabled you to decide who was guilty. May Allah always

bless you with his bountiful mercy." "Gracious man," replied the Caliph, "I racked my brains for three days, before I thought of a solution. I merely had you and the imposter led past the stable where your horse was quartered, and I observed that your horse recognized your voice and your footsteps, and I was certain that you were the rightful owner of the horse." (Baldwin: Fifty Famous Stories; 1896.)

This ability, for which the Caliph was justly honored, of reducing his problem to its elements and of approaching it from a truly investigative point of view, cautiously and objectively, is likewise possessed to an unusual degree by the man whom we welcome tonight as our new President. It enabled him to support himself while attending high school and college, to graduate with high honors, and to be elected to the society of Sigma Xi. It enabled him to initiate and develop a program of dental research at his Alma Mater, Ohio State University. If one were to dissect his personality, the trait of sincerity would, I believe, be found to be one of his outstanding characteristics; and for sincerity there is no substitute. I present him to you as a fellow research worker, as a fellow teacher, as a fellow student, and as a man. Those who really know Paul Kitchin appreciate him. May you all have that opportunity before the end of next year.

III. Inaugural Address

Paul C. Kitchin, B.S., M.S., D.D.S., F.A.C.D., Dental School, Ohio State University, Columbus, Ohio

One cannot but be impressed, from a national as well as a professional point of view, by the rich historic setting of this meeting. Maryland—"the Old Line State," from the days of Sir George Calvert, the earliest Lord Baltimore, down through the years—has been first in many ways. Since its beginnings, between Chesapeake Bay and the Potomac River, events have transpired on that peninsula which were destined to exert a powerful influence on our national history and the path of social progress. Baltimore has been called "the most western of the eastern ports and the most northern of the southern ports." In the days before steam the famous Baltimore clippers were the pride and toast of the nation. When Morse's

first public telegraph message was sent from Washington it went to America's first passenger and freight railway station in Baltimore. The first metal writing-pen was made here, and the first revolving printing press was used here, the first submarine was made in Baltimore, and it was the first city to be lighted by gas.

A consideration of all these pioneering efforts makes it less remarkable to an outsider that Baltimore should have been the place where Bond, Baxley, Hayden and Harris established the first dental school. As a loyal son of another famous state, I hasten to add that the flickering light of the torch that was dentistry in Baltimore was soon reinforced by a second torch on the banks of the Ohio. Others followed and the century which has now almost run its course has seen that first dental college multiplied over forty fold on this continent.

In the midst of this rich profusion of national and professional historical associations I, for one, find myself frankly abashed. In the status in which I come before you at this meeting, the words of Emerson assume for me an even greater significance than they have had under other circumstances, when he said: "There comes a time in every man's education when he arrives at the conviction that envy is ignorance, that imitation is suicide, that he must take himself for better, for worse as his portion." To be selected for the presidency of the International Association for Dental Research is a signal honor. In the past it has been bestowed on a group of illustrious men, each of whom richly deserved the distinction which the office carries. For my own part I am subject to no hallucinations regarding the value of anything that can be called a personal contribution to dentistry. I do derive some degree of consolation, however, from this statement by C. F. Kettering in his delightful address, "The Rocky Road of Research:" "Unintelligent motion is more important in research than intelligent standing still." I like to assume that I have been, at least at times, in motion.

It is with a keen appreciation of the confidence you have placed in me, and an equally keen realization of my shortcomings, that I enter into the presidency of this Association. It represents to me the embodiment of what Waite, in a recent article on dental education, calls "climbing the hill back to scientific and professional status."

This Association is an organization devoted to the purpose of attacking the problems of dentistry with the weapons provided by the fundamental sciences, and of maintaining an open road for the publication, in a scientific *Journal*, of such information as may result from this attack. In the years to come the man who founded and nourished this Association, and all of us whose feeble efforts may have in any measure added to its growth, will have increasing cause to be proud of the part that the International Association for Dental Research will have played in the history of the dental profession.

IV. Index of Names of Participants, and Sequence Numerals of Corresponding Abstracts

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V. First Session: Morning, March 13; Abstracts 1–12

1. Dr. benjamin fendall (1753–1818): pioneer american dentist. *J. Ben Robinson, D.D.S., F.A.C.D., Dental School, University of Maryland, Baltimore, Md.* Dr. Fendall, born in Charles County, Md., in 1753, was directly descended from Josias Fendall, fourth

* No manuscript received for publication.

colonial Governor of Maryland. Practised dentistry from 1773 to about 1805. Numerous announcements of his movements from city to city, and surprising quality of work described in press notices, indicate cultured educated gentleman, ranking among best qualified dentists of 18th-century America. He specifically stated he was trained physician specializing in dentistry. Practice included all operations customarily performed by dentists of period. In addition, showed interest and indicated proficiency in correcting cleft palate, doing extensive oral surgery, regulating teeth, and treating children's teeth. Apparently first American dentist of note and first medically trained dentist in America.

2. DOES RESECTION OF NERVES SUPPLYING MANDIBLE AFFECT DEVELOPMENT OF TEETH? *L. F. Edwards, B.A., M.S., Ph.D., and P. C. Kitchin, B.S., M.S., D.D.S., Dental College, Ohio State University, Columbus, Ohio.* Unilateral resection of superior cervical sympathetic ganglion in four kittens always resulted in acceleration of growth of permanent tooth germs of mandible on operated side, as compared with those on unoperated side, relative percentage increase varying from 2 to 15 percent as calculated from measurements of tooth germs in roentgenograms and in photographic enlargements. After unilateral resection of inferior alveolar nerve in two kittens, growth of only 60 percent of tooth germs on operated side accelerated, relative percentage increase varying from 1 to 7 percent. *Conclusion:* Resection of vasoconstrictor (sympathetic) fibers supplying tooth germs accelerates growth; resection of afferent (somatic) fibers of inferior alveolar nerve no definite effect on rate of tooth development.

3. SUBMERGING DECIDUOUS TOOTH. *William G. Skillen, D.D.S., and G. A. C. Walley, L.D.S., D.D.S., M.S.D., Dental School, Northwestern University, Chicago, Ill.* So-called "submerging deciduous tooth" described, clinically and histologically, by several orthodontists. Twenty cases in present etiological study. In two: little or no tooth resorption; none of usual bony union or replacement of tooth structure, ruling out ankylosis, previously regarded as usual cause of failure to erupt. In two cases mentioned, cause seemed to be failure of eruption alone, which possibly lies behind all. Dentin in all (20) cases very poorly calcified. In few, having epithelial attachment, terminated at enamel-cemental junction—also indicating

delayed eruption. Complete physical examinations not made. Evidence (slight) indicates eruptive process stimulated by proper orthodontic means.

4. INTERNAL RESORPTION. *M. S. Aisenberg, D.D.S., F.A.C.D., Dental School, University of Maryland, Baltimore, Md.* Two known types of internal resorption: one in root canal; one in coronal pulp. Chronic infection causes former. Etiology of latter unknown; usually attributed to systemic disorder. One such case described. Both constructive and destructive processes present. Pulp converted to adult connective tissue. Resorption in one instance caused pulpal exposure. Epithelial proliferation through lateral perforation resulted in cyst formation in pulp. Epithelium traced to rests in periodontal membrane. Resorbed surfaces undergoing repair with secondary cementum. Bone metaplasia in pulp of one tooth.

5. ERRORS DEVELOPED BY USE OF CENTRAL BEARING-POINT IN ADJUSTMENT OF ARTICULATORS. *Carl O. Boucher, D.D.S., School of Dentistry, Ohio State University, Columbus, Ohio.* Central bearing-point develops error when used in obtaining lateral and protrusive checkbites for adjustment of three dimensional articulators; reduces interdental space determined in try-in. Two flat plates, equipped interchangeably with central, lateral, and incisal bearings, mounted on articulator. Comparative measurements of space between plates taken at definite points in molar and cuspid region, each side. Closure with central bearing-point amounted to 0.2 mm. in molar region, 0.6 mm. in cuspid region, in lateral protrusion. In forward protrusion, reduced 0.4 mm. in molar region, 1.0 mm. in cuspid region, compared with incisal bearing. (Condylar inclination of 30° and 3 mm. protrusion used for records.) Steeper condylar inclination produces greater amount of closure, while horizontal condyle-path shows no change, when central bearing-point used. Arbitrary raising of height of central bearing-post cannot correct error. Effect from practical standpoint: reduces height of cusps of posterior teeth, shortens incisors, on articulator after final try-in.

6. TEST OF EFFECT OF DISTURBED RHYTHM OF ACTIVITY AND REST ON TRANSVERSE PRISM-STRIPES. *S. W. Chase, A.M., Ph.D., and J. M. Werle, A.B., Dental School, Western Reserve University, Cleveland, Ohio.* For 16 hours daily, 6 days weekly, 5 weeks, four rats kept in

enforced activity in motor-driven cage revolving 80–90 times each hour. During remaining 8 hours daily, and during seventh day, cage at rest. Food and water constantly accessible; also to controls kept in similar but stationary cage. Daily number minutes activity of experimental animals more than twice that of controls, and number minutes of rest less than half, yet without demonstrable difference in length, spacing, or rhythm of deposition of transverse prism-stripes in enamel formed during experiment in incisors of either group. Same findings obtained in two rats in which subcutaneous injections of sodium barbital enforced semi-weekly periods of coma followed by lethargy. *Conclusion:* Rhythm of activity and rest not factors in causation of rhythmic deposition of enamel substance.

7. TEST OF EFFECT OF INTERMITTENT WATER-DEPRIVATION ON TRANSVERSE PRISM-STRIPES. *S. W. Chase, A.M., Ph.D., and J. M. Werle, Dental School, Western Reserve University, Cleveland, Ohio.* Four rats deprived of drinking water 24 hours, then supplied with water 24 hours, alternately 7 days; then supplied with water 48 hours; 9-day cycle repeated 5.5 weeks. Food constantly available. Transverse prism-stripes in enamel of incisors experimental rats measured and compared with controls: no demonstrable difference in length, spacing, or rhythm of deposition. *Conclusion:* Rhythmicity of water-intake not causative factor in rhythmic deposition of enamel substance.

8. LOCAL ANESTHETICS: HISTOPATHOLOGIC EFFECTS OF pH, HEMOLYSIS, AND INDIVIDUAL CHEMICAL CONSTITUENTS. *P. C. Kitchin, B.S., M.S., D.D.S., F.A.C.D., H. M. Weaver, B.A., M.S., and R. D. McFarland, D.D.S., Dental College, Ohio State University, Columbus, Ohio.* Authors noted reactions, in albino rats, of loose connective tissue around sciatic nerve, and nerve tissue itself, to injections: (*a*) buffer solutions of different pH values, (*b*) solutions of differing hemolytic activity, and (*c*) solutions of common individual components of stock local-anesthetics—in 0.9 percent NaCl, and amounts generally used. Duration of tissue reactions: 27 hours. Only two rats used for each of various 0.5 cc. injections. Seven of Sörensen's phosphate series used for pH, 8.043 to 5.288; four of Sörensen's glycocoll-HCl series for pH, 3.679 to 1.038. In general, lower pH accompanied by greater hemolyzing activity, resulting in more con-

nective-tissue reaction; no effect on nerve tissue. Hemolyzing activity and connective-tissue reaction directly proportional. Nerve degeneration occurred with hemolyzing activity of 60 percent and above—not supported by pH series. Where results not complicated by hemolyzing action and low pH, 2 percent procaine and 0.125 cc. glycerin (c.p.) per cc. of solution (both in 0.9 percent NaCl) gave most connective-tissue reaction; none on nerve tissue.

9. TREATMENT OF ORAL INFECTIONS WITH ULTRA-SHORT WAVES. *J. S. Oartel, M.S., D.D.S., F.A.C.D., School of Dentistry, University of Pittsburgh, Pittsburgh, Pa.* Treatment of infected root-canals with ultra-short waves continued; satisfactory results. To date, twenty-five cases treated; generator operated on wave length of 6 meters with 175 watts output. One case, two teeth so treated: sterile for fifteen months. Rarefied areas about apices filled with new bone. Treatment valuable in osteomyelitis, pulpitis induced by mechanical irritation, Vincent infection, and streptococcal infection of oral mucous-membranes.

10. VARIATIONS IN TEMPERATURE OF NORMAL LABORATORY RABBITS. *W. F. Swanson, M.S., D.D.S., F.A.C.D., L. E. Van Kirk, M.S., D.D.S., F.A.C.D., and E. A. Wolf, Ph.D., Dental School, and Department of Biology, University of Pittsburgh, Pittsburgh, Pa.* In work on focal infections, became important to know mean temperature of normal rabbits; no precise information available. Temperature measurements of 17 normal and 1 infected rabbit, hourly 24 consecutive hours. *Results:* Maximum fluctuation of temperature (degrees C.) in one normal rabbit, 1.05; in infected one, 2.3. Average standard deviation of hourly fluctuations: males, 0.17; females, 0.14; infected rabbit, 0.42. Mean temperature for 9 males, 39.04 ± 0.021; females, 39.11 ± 0.015; whole normal group, 39.07 ± 0.013; infected, 40.38 ± 0.099. Difference between males and females, 0.07. (Index of significance of difference, 2.7.) Mean temperature for extreme (male albino), 38.47 ± 0.034; difference between total population and this case, 0.60. Significance of difference, 17.85. Diurnal fluctuations of temperature (periods of six hours) differed maximally by 0.04 (index of significance, 1.08). (To be published in *Science*.)

11. MECHANISM OF TOOTH REPLACEMENT IN SPHYRÆNA BARRACUDA. *Theodore B. Beust, M.D., D.D.S., F.A.C.D., School of Dentistry,*

University of Louisville, Louisville, Ky. During study of tooth attachment in barracuda pike, observed minute foramina situated immediately beneath epithelial attachment on lingual surfaces of teeth. Epithelial lamina containing germ of replacing tooth resorbs into functional member at point named. Replacing tooth thereafter undergoes complete development within body of tooth to be replaced.

12. SYSTEM OF STUDY OF EXPERIMENTAL DENTAL CARIES AS RELATED TO NUTRITION. *Gerald J. Cox, Ph.D., Buhl Foundation, Mellon Institute for Industrial Research, Pittsburgh, Pa.* Nutritive factors directly operative in dental caries separable for study into three fields: (*a*) those concerned in formation of teeth; (*b*) those that initiate decay; (*c*) those that arrest or promote rate of decay in existing lesions. In experimental study of (*a*) and (*c*), coarse cereal diets used to initiate caries in rats—only published *method* that uniformly induces caries. *Results:* Diet of mother during pregnancy and lactation influences caries susceptibility of young. Increased haliver oil, increased Ca and P, high-fat diet, or meat diet to mothers caused increased immunity to corn-meal caries in offspring. Diets containing large amounts of fermentable carbohydrate increase rate of decay; fats arrest; increased haliver oil no effect.

VI. SECOND SESSION: AFTERNOON, MARCH 13; ABSTRACTS 13–25

13. INTERPROXIMAL SURFACES. *Grant Van Huysen, D.D.S., and H. S. Moon, Dental School, Medical College of Virginia, Richmond, Va.* Interproximal surfaces of 341 extracted teeth studied with X2 magnifying glass and no. 17 explorer. *Results:* 405 facets, and 393 different areas of caries, on surfaces examined. Of areas of caries, 142 (36%) within boundaries of facets, 48 (12%) outside of facets; for 203 (52%), location of origin indeterminate.

14. BONE CHANGES FOLLOWING CONSERVATIVE PERIODONTAL TREATMENT. *Sidney Sorrin, D.D.S., College of Dentistry, New York University, New York City.* Cases varied in character as to age, sex, occupation. Pocket formation, suppuration, mobility present before therapy. Pocket formation determined by application of probe into pocket. After treatment, pocket closed, suppuration ceased, teeth much firmer, and gingival tissues acquired healthy color. Impossible to pass probe into areas where pockets previously existed.

Interesting bone changes noted by roentgenographic examination. Patients under observation for many years following treatment; with few exceptions, no recurrence. Bone regeneration clearly demonstrated; periodontal tissues remained in good health since completion of treatment—usually establishment of occlusal equilibration, careful instrumentation of hard and soft tissues in pocket, and instruction in gingival massage and diet. No systemic complications. Pinledge splints, continuous-clasp dentures, and ligatures most helpful in effecting cure, because of assistance in immobilizing teeth.

15. TWENTY SELECTED CASES FROM SPECIAL CHILDREN'S GROUP, HARVARD DENTAL SCHOOL. *Paul K. Losch, D.D.S., and Fred W. Morse, Jr., B.S., M.D., Dental School, Harvard University, Boston, Mass.* Five boys and five girls showing highest incidence of carious involvements compared with five boys and five girls showing little or no caries. Comparisons made on prenatal, family and infancy histories; also on current examinations, dental and physical, from date of admission to last clinical examination. Statistically: trend slight, but positive correlation for both high- and low-caries groups in pregnancy toxemia, prenatal diet, infant feeding, health habits (sunshine, sleep, fresh air, exercise, etc.), rickets, posture, occurrence of aciduric bacilli, current dietaries. Trends undifferentiated or negative: signs or history of scurvy; family history (parents); progressive rise and fall, or differentiation, in height and weight; development of wrist bones compared with lateral jaw roentgenographs; teething; eruption and shedding-time of teeth; pernicious dental habits.

16. CHEMICAL COMPOSITION AND ACIDITY OF SILICATE CEMENTS. *Irl C. Schoonover, Ph.D., National Bureau of Standards, Washington, D. C.* Results of chemical analysis of eleven dental silicate-cement powders and of five silicate-cement liquids; also data on solubility and disintegration of cements in distilled water, and pH values for water mixtures of mixed cements, cement powders, and cement liquids. Correlations between chemical composition and physical and chemical properties indicated. (To be published in *J. Am. Den. Assoc.*)

17. SILICATE CEMENTS: MEASUREMENTS OF OPACITY AND STABILITY

OF LIQUIDS AT DIFFERENT HUMIDITIES. *George C. Paffenbarger, D.D.S., F.A.C.D., Research Associate, American Dental Association; National Bureau of Standards, Washington, D. C.* Apparent daylight reflectance (R_o) of cement specimen (1 mm. thick) when placed over black-glass backing, divided by apparent daylight reflectance ($R_{.70}$) of same specimen when placed over white-glass backing (whose apparent daylight reflectance relative to MgO is 70 percent), gives relative opacity ($C_{.70}$) of cement. Thus, $\frac{R_0}{R_{.70}} = C_{.70}$. When R_o and $R_{.70}$ are identical, $C_{.70} = 1.00$, and cement is 100 percent opaque. Numbers below 1.00 indicate degree of opacity. Opacity ($C_{.70}$) of different trade brands of 7-month-old cement specimens ranged from 0.21 to 0.64. Value for human enamel, 0.39; human dentin, 0.70. Gain or loss in weight of cement liquids at various humidities, and resultant changes in times of setting of cements, indicated some cements critical as to water content. In relative humidity in equilibrium with cement liquid, no appreciable changes occur in water content of liquid—practical method of keeping composition of liquid constant. (To be published in *J. Am. Den. Assoc.*)

18. RESEARCH ON DENTURE-BASE MATERIALS. *W. T. Sweeney, A.B., Research Associate, American Dental Association; National Bureau of Standards, Washington, D. C.* Physical and chemical tests on variety of non-metallic denture-base materials, to determine relative suitability for making dentures, in progress. Cellulose compounds, vinyl resins, phenol-formaldehyde resins, vulcanites, etc., studied as to tensile and transverse strengths, modulus of elasticity, hardness, internal strain, color stability, solubility, permanence of form, and degree of curing, including development of suitable testing methods and collection of quantitative data under controlled conditions. (To be published in *J. Am. Den. Assoc.*)

19. TESTING OF CERTIFIED MATERIALS. *John R. Beall, B.S., Research Associate, American Dental Association; National Bureau of Standards, Washington, D.C.* Several surveys completed on amalgam alloys, inlay casting investments, impression compounds, inlay casting waxes, inlay casting golds. In tests of amalgam alloys, investments, inlay waxes, and inlay golds, some products found not to comply with A. D. A. specifications. Products omitted from list of certified materials, and manufacturers promptly notified. Pro-

gram benefits profession by indicating materials having properties within safe limits. (Lists of certified materials and results of testing program published periodically in *J. Am. Den. Assoc.*)

20. FACTORS IN SALIVA CORRELATED WITH OCCURRENCE OF SALIVARY CALCULUS. *Benjamin Tenenbaum, B.S., D.D.S., and Maxwell Karshan, A.M., Ph.D., Medical and Dental Schools, Columbia University, New York City.* Saliva of persons with and without calculus analyzed for total Ca, inorganic P, pH, protein. Saliva, stimulated by chewing paraffin, collected in three successive portions, 1–3 hours after breakfast. First portion (1–2 cc.), collected under paraffin oil, used for initial pH; second portion (10–12 cc.) used for Ca, P, protein; third portion (1 to 2 cc.), collected under oil, used for second pH determination. Of 49 persons 20–52 years old, 29 were calculus-free; no previous dental prophylactic treatment for at least one year. Remainder, varying degrees of deposit. Mean values for Ca and P in calculus-free group lower than in calculus group: difference in mean of Ca definitely significant; difference in P probably significant. Mean pH lower, and mean protein content higher, in calculus-free than in calculus group; but neither difference statistically significant. Data indicate Ca and probably P in stimulated saliva correlated with occurrence of calculus. (Aided by grant from Carnegie Corporation.)

21. DENTAL CARIES AND RELATED MOUTH CONDITIONS AMONG ESKIMOS OF KUSKOKWIM REGION, ALASKA.[3] *Theodor Rosebury, D.D.S.,*

[3] The expedition to Alaska that provided the data in this and the four succeeding abstracts, was the seventh in the series under the general direction and leadership of Dr. L. M. Waugh, of the Dental School of Columbia University, and Dental Director (R) of the United States Public Health Service. The expenses of the expedition were defrayed with the aid of a grant from the Office of Indian Affairs, U. S. Department of the Interior. The follow-up research at Columbia University was conducted with the aid of a grant for dental research from the Carnegie Corporation. Technical assistance for chemical analyses of foods was provided by a special grant from the Office of Indian Affairs. Dr. Rosebury gratefully acknowledges the invaluable guidance of Dr. L. M. Waugh who, with his son, conducted a preliminary bacteriological study in the same region in 1935 and reported the results at the general meeting of this Association (I.A.D.R.) a year ago (L. M. Waugh and D. B. Waugh: *J. Den. Res., 15:* 317, 1936, where references to the earlier reports by Dr. Waugh are given). Valuable information and assistance were provided by Dr. T. J. Pyle, Mrs. L. A. Heron, Mrs. H. Oman, Mr. C. Foster Jones, Mrs. Mary L. York, and Mr. Willard R. Olsen. (For additional data relating to Dr. Waugh's further study see abstract 125.) Abstracts 21 to 25, inclusive, are presented here in the sequence preferred by the authors. At the meeting, paper 23 was presented by Dr. Karshan; papers 21, 22, 24 and 25 in a group by Dr. Rosebury.—[*Ed.*]

Medical School, Columbia University, New York City. By careful examination with mouth-mirror and explorer, 106 Eskimos from Bethel and vicinity, and from lower Kuskokwim and coastal villages, classified for bacteriological and chemical study as (active) *caries* (36), *caries-free* (44), and (caries-activity) *doubtful* (26). Clinical study of 18 additional natives (Moravian orphanage near Bethel). Incidence of caries progressively lower in groups with advancing average age; highest among natives from settlements in close contact with white men; lowest among most primitive natives. Irregularities of alignment or occlusion, and infrequent enamel hypoplasia, not correlated with caries. Apparent inverse relationship between attrition and caries invalidated by increase of attrition with advancing age. Part of inverse relationship between salivary calculus and caries not attributable to age. Distribution of caries, by affected teeth, similar to that in other races. In permanent teeth, caries chiefly occlusal; in deciduous teeth, chiefly approximal, with no unusual characteristics. Cervical cavities rare; approximal cavities of permanent teeth uncommon. Data indicate caries among Eskimos clinically similar to caries elsewhere; relatively new disease, affecting principally young; apparently directly related in degree to accessibility of natives to white man.

22. ACIDURIC FLORA OF SALIVA OF KUSKOKWIM ESKIMOS, WITH AND WITHOUT DENTAL CARIES.[4] *Theodor Rosebury, D.D.S., Medical School, Columbia University, New York City.* Saliva from 106 Eskimos (abstract 21) plated on pH 5.0 tomato-agar by Hadley method (*J. Den. Res., 13:* 198, 1933), and inoculated into 1 percent dextrose chopped-meat broth, pH 4.7 and 3.8. Parallel tests with seven subjects using our agar and batch supplied by Dr. Philip Jay showed close qualitative and quantitative agreements. *Results:* Lactobacilli in one or more media for 29 of 36 *caries* subjects (80.6%), 6 of 44 *caries-free* (13.6%), 11 of 26 *doubtful* (42.3%). Lactobacilli per cc. of saliva: averaged 122,350 among positive *caries* plates, 2570 among positive *caries-free*, 34,290 among positive *doubtful*. Yeasts: in one or more media in 11 *caries* cases (30.5%), 1 *caries-free* (2.3%), 6 *doubtful* (23.1%), in approximately uniform concentration. In 12 *caries*,

[4] A continuance of the preliminary bacteriological study among Eskimos in this region by Waugh and Waugh: *J. Den. Res., 15:* 317, 1936.—[*Ed.*]

1 *doubtful*, 0 *caries-free* cases, lactobacilli appeared either in pure culture or accompanied only by yeasts. Lactobacilli in mouths in every geographical group. No correlation between caries and any other organism in media used. Data agree with those reported by Michigan group, and support clinical finding that caries among Eskimos is similar to caries elsewhere.

23. BIOCHEMICAL CHARACTERISTICS OF SALIVA OF KUSKOKWIM ESKIMOS CORRELATED WITH DENTAL CARIES AND SALIVARY CALCULUS. *Maxwell Karshan, Ph.D., and Theodor Rosebury, D.D.S., Medical and Dental Schools, Columbia University, New York City.* Paraffin-stimulated salivas from 49 of 106 Eskimos (abstracts 21–22): 17 *caries*, 28 *caries-free*, 4 *doubtful*, preserved with $HgCl_2$ (on basis of preliminary tests), analyzed for total Ca, inorganic P, CO_2-capacity, and change in Ca and P after shaking with commercial tricalcium phosphate (*J. Den. Res.*, *15:* 383, 1936). Since commercial tricalcium phosphate not uniform in composition, single sample, same as in previous study, used throughout. *Results: Lower* averages in *caries* group for Ca, P, CO_2-capacity, and Ca removed after shaking; *higher* average in *caries* group for P removed after shaking. Differences between caries and caries-free groups generally like those previously reported, further indicating similarity of Eskimo caries to caries elsewhere. Same data correlated with salivary calculus: 28 *low-calculus* cases (including 16 of 17 *caries* cases) gave average values similar to caries group; 20 *moderate* or *high-calculus* cases, similar to *caries-free* group. Data suggest inverse relationship between caries and salivary calculus. Results for total Ca and inorganic P similar to those reported by Tenenbaum and Karshan (abstract 20). Attempt to coördinate chemical data with bacteriological data for Eskimos (abstract 22) shows little relationship in individual subjects. Two methods may yield information on dissimilar mechanisms, both related to activity of caries.

24. DIETARY HABITS OF KUSKOKWIM ESKIMOS, WITH VARYING DEGREES OF DENTAL CARIES. *Theodor Rosebury, D.D.S., and Maxwell Karshan, Ph.D., Medical and Dental Schools, Columbia University, New York City. Kipnuk*, primitive native village without resident trader; 9 examined; *caries* (average of carious teeth) 1.2%—*diet* largely fish, meat, fat; few roots, greens; berries in summer; tea

popular, without sugar; no milk, but children nursed four years or more; average diet probably not deficient, but deficiencies due to deprivation may occur; probably has acid ash. *Eek*, isolated native village with resident trader; 20 examined; *caries* (mainly in children) 18.1%—*diet* as at Kipnuk, but more white man's food: abundant flour (chiefly for seal-oil pancakes), sugar, pilot bread; moderate candy; little other cereal; little milk. *Moravian orphanage*, isolated, with supervised diet, *caries* (among 18 full-native inmates), 10.0%—*diet* composite of native and white: no seal or seal oil, but butter and commercial fat; white man's food plentiful and varied, including fresh and canned vegetables, fresh and dried fruit, canned milk, cereals; abundant flour (chiefly for bread) and sugar; more candy than at Eek, less pilot bread. Orphanage diet probably highest in carbohydrate, most alkaline in ash, most constant. Orphanage children brush teeth and have clean mouths, receive some dental care; no dental care at Kipnuk or Eek. Cod-liver oil available at each of three places in winter. Additional data, with food analyses, in preparation.

25. INTERPRETATION OF RECENT CLINICAL AND EXPERIMENTAL DATA ON ETIOLOGY OF DENTAL CARIES. *Theodor Rosebury, D.D.S., Medical School, Columbia University, New York City.* If strictly native Eskimo diet yields complete freedom from caries, wide variation and effects of scarcity suggest diet inactive rather than protective; high protein-high fat may exert partial protection; deficiencies probably occur intermittently. Association with white man results in caries; hence white man's diet may provide active primary causes, beyond deficiencies introduced or aggravated. If so, causative foods should occur in limited list of white man's foods used by Eskimos. Principle for selection, otherwise lacking, provided by data on rat caries (*J. Am. Den. Assoc., 22:* 98, 1935; *Arch. Path., 20:* 697, 857, 1935). Besides close parallels with man in appearance of lesions and secondary factors, primary causative principle in rats known: hard, compact, carbohydrate-rich foods. Applying principle to lists of white man's foods used by Eskimos, only two appear culpable: pilot bread (ship's biscuit) and certain kinds of candy. Consumption of pilot bread correlated quantitatively with incidence of caries at Eek, Orphange, and Kipnuk; used in abundance by Eek children (abstract 24). *Hypothesis:* Foods analogous to pilot bread direct

causes of caries in man. Tested in rats, pilot bread-sugar-spinach diet produced fissure caries, interproximal caries, no fractures; lesions few, small, but unquestionable. Hypothesis requires testing in man. *Noteworthy:* "biscuits" a characteristic product of white civilization, which caries accompanies.

VII. Third Session: Evening, March 13; Abstracts 26–36

26. Strength of bite and condition of teeth in men and supermen. *Peter J. Brekhus, B.A., D.D.S., F.A.C.D., Wallace D. Armstrong, Ph.D., and William J. Simon, B.A., D.D.S., School of Dentistry, University of Minnesota, Minneapolis, Minn.* Subjects: selected group from Physical Education Department, University of Minnesota (1936 football players), compared with equal group of average students same University. *Findings:* Table I. *Results:* No significant difference in strength of bite and dental condition.

TABLE I

Comparative data: athletes and dental students

	ATHLETES (108 CASES)	DENTAL STUDENTS (108 CASES)	DIFFERENCE
Age (average)	21.00	23.00	2.00
Height (average)	72.00	69.00	3.00
Weight (average)	176.00	158.00	18.00
Surface area (average)	1.99	1.86	.13
Bite (average)	126.00	125.00	1.00
Fillings and cavities per student (average)	11.00	13.00	2.00
Missing teeth per student (average)	3.00	3.00	...
Mean var. from aver. ht.	1.74	2.00	.26
Mean var. from aver. wt.	16.05	15.40	.65
Mean var. from aver. bite	23.87	23.09	.78
Mean var. from aver. no. fillings and cavities	3.55	4.53	.98
Mean var. from aver. no. missing teeth	1.95	2.10	.15

27. Fluorine content of enamel of sound and carious teeth. *W. D. Armstrong, Ph.D., and P. J. Brekhus, B.A., D.D.S., F.A.C.D., Dental School and Laboratory of Physiological Chemistry, University of Minnesota, Minneapolis, Minn.* Specimens of enamel (33) from sound teeth had mean F content of 0.0111 percent; 31 from carious teeth, 0.0068 percent. Results shown to have statistical significance.

Low F content of enamel of carious teeth not apparently secondary to carious process.

28. SIGNIFICANCE OF STREPTOCOCCI IN PULPS OF INTACT TEETH. *Ruth Tunnicliff, A.B., M.D., and Carolyn Hammond, B.S., M.A., John McCormick Institute for Infectious Diseases, and Foundation for Dental Research of Chicago College of Dental Surgery, Chicago, Ill.* Sixty-four intact teeth treated with antiseptics and cultured eight days in glucose-brain broth to determine sterility. Thirty teeth, showing no growth, opened aseptically; smears, sections, cultures of pulp studied. Str. viridans, occasionally associated with diptheroids, isolated from ten pulps from externally sterile intact teeth. No sign of infection in smears or sections of pulps containing streptococci; presence therefore not significant. (To be published in *J. Am. Den. Assoc.*)

29. BACTERIOLOGY OF DENTAL PULP. *John H. Gunter, D.D.S., M.D., J. L. T. Appleton, B.S., D.D.S., Sc.D., Jane Strong, J. C. Reader, D.D.S., E. A. Zimmerman, D.D.S., and J. J. Brooks, D.D.S., School of Dentistry, University of Pennsylvania, Philadelphia, Pa.* "Vitality" of pulp determined by clinical, roentgenologic, and electrical examination. Series included teeth having intact crowns; carious teeth, filled and unfilled; teeth having gingivitis and parodontosis; teeth with *adjoining* ones normal or showing gingivitis, parodontosis and periapical involvement. Rubber dam applied; surface painted with tincture of iodine and alcohol; intact area of enamel and dentin cut through with sterile stone. Just before operator expected to drop into pulp chamber, some of dentin dust transferred to hormone broth. Actual exposure with bur; tip with adherent pulp dropped into another tube of hormone broth. Tooth extracted with special effort to protect root and apex from salivary contamination. Apex cut off and put into tube of hormone broth. Seventeen teeth thus examined. Growth in only one of dentin cultures; in none of pulp; in all of apical ones. *Results* do not confirm previous reports of presence of bacteria in living, human dental pulp; cast doubt on clinical significance of positive apical cultures from extracted teeth.

30. SILVER-IMPREGNATION METHOD FOR HARD-TISSUE SECTIONS. *Hamilton B. G. Robinson, M.S., D.D.S., School of Medicine and Den-*

tistry, University of Rochester, Rochester, N. Y. Slabs, 1 mm. or less in thickness cut by milling machine from teeth mounted in plaster, placed (*a*) in dark in fresh solution of acidulated Ag NO_3; (*b*) in direct light in water; (*c*) in x-ray developer; (*d*) in x-ray fixer—each for 12 hours. Then polished, both sides, on coarse, revolving alundum lap, mounted on brass discs (method of Chase: *J. Den. Res., 10:* 251, 1930), and ground under water on coarse (180 M) alundum revolving lap until about 50 microns thick; on fine (80 M) alundum lap until as thin as skill permits (20 microns or less); finally polished on Arkansas lap. Cutting and grinding method gives number of sections from one tooth; little waste of tissue; no incorporation of grinding material; reasonably uniform sections. Ag NO_3 staining shows dental tubules and branches in black and white; enamel rods also more plainly visible. In effect: photographic film of tooth slab, exposing, developing, and fixing it. (To be published in *J. Den. Res.*)

31. PHYSICAL STUDIES OF DENTAL HARD TISSUES. I: DENSITY. *R. S. Manly, B.S., M.A., and H. C. Hodge, B.S., M.S., Ph.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Density distribution curves of enamel, dentin and cementum investigated by centrifugal method previously developed for separation of above hard tissues. (*a*) Four determinations on composite of dried enamel: limits of density curve at 2.89–3.02 grams per cc.; two maxima at 2.91 and 2.97. Four determinations, each on enamel from single tooth, gave curves with maxima and minima at same density. (*b*) Four determinations on dried dentin-composites established limits at 2.00–2.30 grams per cc.; mean density, 2.14. (*c*) Duplicate determinations of composites of hypercementosed roots: cementum density of 2.01–2.05 grams per cc.

32. PHYSICAL STUDIES OF DENTAL HARD TISSUES. II: REFRACTIVE INDEX. *R. S. Manly, B.S., M.A., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Mean refractive indices of samples of enamel, dentin and cementum, having different densities, determined by Becke line-method. (*a*) Refractive index of enamel: 1.612–1.630; proportional to density. (*b*) Refractive index of dentin: 1.555–1.580; proportional to density only when dentin not subjected to extreme drying conditions. (*c*) Refractive index of

cementum: 1.562–1.565; value higher than expected from place on dentin-density curve.

33. HARDNESS STUDIES ON TEETH. *Harold C. Hodge, B.S., M.S., Ph.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Aided by vertical polarized light, microhardness values for transparent peripheral zone in dentin next to enamel in 196 teeth ranged from 100 to 173. Values for transparent zone compared with average for normal-appearing coronal dentin in same tooth: numbers of softer and harder transparent zones approximately equal. Hardness of transparent zone in given tooth not significant without complete history of tooth.

34. PRINCIPAL INORGANIC MOLECULE OF TOOTH SUBSTANCE. *Harold C. Hodge, B.S., M.S., Ph.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Because chemists have traditionally represented results of analyses as compounds or combinations of oxides, or more recently as combinations of simple molecules, principal inorganic molecule of tooth or bone substance often written as tricalcium phosphate, $Ca_3(PO_4)_2$. X-ray diffraction studies have confirmed findings of others that molecule belongs to apatite family of minerals, having crystalline arrangement very similar to fluorapatite: empirical formula, $3Ca_3(PO_4)_2 \cdot CaF_2$. F apparently replaced by hydroxyl groups in inorganic molecule; indicated formula, $3Ca_3(PO_4)_2 \cdot Ca(OH)_2$, hydroxylapatite. Unit cell, or simplest arrangement of atoms including all necessary for hydroxylapatite: complicated structure involving hydroxyl ions, P atoms with tetrahedra of O atoms, and Ca atoms; molecular weight about 1100.

35. ASH AND MOISTURE CONTENTS OF TOOTH SUBSTANCE. *Marian L. LeFevre, M.S., and R. S. Manly, B.S., M.A., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Ash and moisture contents determined separately on enamel and dentin of 41 teeth; two patients. Powdered enamel and dentin separated by centrifugal density method, equilibrated in 100 percent humidity atmosphere; organic matter extracted with 3 percent KOH in ethylene glycol; percentages for dentin plotted. Organic matter varied inversely as inorganic, directly as moisture, suggesting moisture in tooth associated with organic matter. Values for two patients fall about two different curves; slopes parallel. Teeth grouped according to extent

of caries: increase in moisture and organic matter, decrease in inorganic matter, in dentin associated with greater extent of caries.

36. TITLE ABBREVIATIONS FOR AMERICAN DENTAL PERIODICALS, AND BIBLIOGRAPHIC METHODS. *T. F. McBride, D.D.S., School of Dentistry, University of Pittsburgh, Pittsburgh, Pa.* In bibliographic work, uniform periodical title-abbreviations important to research workers. Investigators need accuracy in references, ease in interpretation, convenience in locating. Uniformity in journalistic use desirable. Representative, responsible American sources consulted. General agreement: (*a*) follow exact order of words, (*b*) make as brief as consistent with clearness, (*c*) attain uniformity. *Index-Catalogue* says convenience of reader more important than rigid adherence to uniformity. Nearly all abbreviations *in combinations* clear, even when brief; such combinations almost automatically suggest *full title*. List of basic abbreviations compiled. Departures from present usage: one exception to Am. for American, when refers directly to American Dental Association (J.A.D.A.), conforming to usage of American Medical Association (J.A.M.A.); Association, A.; Bulletin, Bul.; College, Col.; Dental, D., and Dentistry, Den. (consistent with usage of M. for Medical, Med. for Medicine); Journal, J.; Quarterly, Quar.; Research, Res. To attain uniformity, each dental periodical should print in conspicuous place own acceptable abbreviation (on cover, contents page, mast-head, with index, etc.). *Periodical citations* (based on *Index-Medicus* and Ingo Hackh): author, article, abbreviation periodical title, volume (bold face), page, month, year. *Book citations* (based on University of Chicago Press): author, title (italic), edition, place of publication, publisher, date, paging. (To be in Report of Committee on Abbreviations, American Association of Dental Editors, Atlantic City, July, 1937.)

VIII. FOURTH SESSION: MORNING, MARCH 14; ABSTRACTS 37–47

37. FACTORS INFLUENCING INCIDENCE OF CARIES IN POPULATION MASSES. *C. A. Mills, M.D., Ph.D., School of Medicine, University of Cincinnati, Cincinnati, Ohio.* On basis of statistics on incidence of caries in school children compiled by Public Health Service and published (May, 1936), author (*a*) noted steady increase in caries with *increasing distance from equator*. In northernmost states, caries

about three times that in states bordering Gulf of Mexico. Latitude factor consistently present along Atlantic and Pacific coasts, and in Central States; apparently related to sunlight intensity; in rural and urban, and white and colored, populations—most striking in colored children. (*b*) Incidence of caries tends to *diminish from river mouth toward headwaters*. With general slope in one direction, caries less in more elevated half than in lower-lying half, suggesting drinking water or food mineral-content factor. Author, investigating two other conditions—relation of caries to (*c*) type of city water-supply, and (*d*) use of salt on food at table—found: of 75 cities questioned as to source and treatment of water (caries rate given in published survey), caries about 40 percent more frequent in those using chlorinated lake or river water than those using untreated well-water. City of Norwood, completely surrounded by Cincinnati, uses untreated well-water; Cincinnati uses treated river water. Caries in Cincinnati school children 50 percent greater than in Norwood children. (*d*) Questioning of 1167 Norwood high school pupils, as to use of salt at table, indicated more caries in those reporting use of *much* salt than in those adding *no* salt; those adding only *little* salt midway in caries incidence. Proportion of perfect sets of teeth almost twice as high in those adding no salt as compared with those adding much salt. (To be published in *J. Den. Res.*)

38. SIGNIFICANCE OF OCCASIONAL RESISTANCE TO DENTAL CARIES. *Alfred Walker, D.D.S., F.A.C.D., Guggenheim Dental Clinic, New York City.* In highly mixed population of North American continent dental decay affects approximately 97 percent of children, adolescents and adults. Generally believed that diet and nutrition play important parts in dental as well as general health, but individuals in same family on identical diets show wide variations in susceptibility and resistance to caries. Variation may range between extremes of rampant decay to complete resistance. Author observed inheritance of tooth forms accompanied by high resistance to caries by males of three generations in one family, grandfather of present living males having visited dentist for first time at age of 74; all teeth then present—no caries excepting beginning of what Bödecker calls "acute root caries." Dietary and manual cleansing received no special attention by members of this family. Well

planned and efficiently executed study of occasional *resistance* to caries should yield clue to elusive "something" determining fate of human teeth. Program for such dental research previously outlined in "definite plan for dental research." (*J. Am. Den. Assoc.*, 24:59, 1937).

39. EFFECTS OF CERTAIN MOUTHWASHES ON NUMBER OF ORAL BACTERIA. *Mary C. Crowley, M.S., and U. Garfield Rickert, D.D.S., F.A.C.D., School of Dentistry, University of Michigan, Ann Arbor, Mich.* Seven mouthwashes tested in two experiments on eight persons, by direct counts of oral flora, before use of mouthwash and three and six hours thereafter. Control counts made at same time of day on different days without use of mouthwash. In first experiment, Pepsodent, Hexylresorcinol, Lavoris, and Listerine used in 1:1 dilution; and Azochloramid, one tablet in 50 cc. of water. Six persons tested, but not all mouthwashes used by each. In second experiment, only two individuals: Pepsodent (in 1:3 dilution), Zonite, Chlorozene, and Azochloramid used. No definite conclusions as to antiseptic values. Great variation in each person, from time to time, in both control and experimental tests. Count methods not reliable for such tests. (To be published in *J. Den. Res.*)

40. RELATION BETWEEN DENTAL CARIES AND POTASSIUM AND SODIUM CONTENTS OF SALIVA. *Julius White, Ph.D., Russell W. Bunting, D.D.Sc., F.A.C.D., Kenneth Thomson, Ph.D., and Philip Jay, D.D.S., M.S., School of Dentistry, University of Michigan, Ann Arbor, Mich.* Spectrographic and chemical analyses of eighty samples of saliva from caries-free and caries-susceptible subjects. High K content (above 50 mg. per 100 cc. of saliva) associated with caries; low K content (below 35 mg. per 100 cc.) associated with freedom from caries. Na content: no definite relationship.

41. EFFECTS OF LOW-SUGAR DIETS ON ORAL LACTOBACILLUS ACIDOPHILUS. *Philip Jay, D.D.S., M.S., and R. W. Bunting, D.D.Sc., F.A.C.D., School of Dentistry, University of Michigan, Ann Arbor, Mich.* Caries tends to increase with excess of carbohydrate in otherwise adequate diets. Not due to disturbance of nutritional balance of diet, but rather to proliferation of lactobacilli in mouth, caused directly by high carbohydrate intake. Conversely, restriction of carbohydrate causes proportional decrease in numbers of lactobacilli in saliva. Extent to which growth of L. acidophilus in saliva may be

influenced varies with individual and inherent susceptibility to dental caries. Addition of di-calcium phosphate and viosterol to unrestricted diets: no numerical effect on oral lactobacilli.

42. EVOLUTIONARY TENDENCIES IN VARIATION IN CROWN-SIZE AND CUSP-PATTERN OF HUMAN TEETH. *Leslie F. Rittershofer, D.D.S., M.S., School of Dentistry, University of Michigan, Ann Arbor, Mich.* Recorded measurements (showing mean, range and standard deviation) of crown dimension, both in mesio-distal and bucco-lingual directions at crown's greatest width, of group of Malayan teeth from Philippine Collections in University of Michigan Museum of Anthropology. (*a*) Greater variation in bucco-lingual diameter than in mesio-distal of upper molars, upper premolars, lower premolars. (*b*) Greater variation in mesio-distal diameter than in bucco-lingual of upper anteriors, lower anteriors, lower molars. (*c*) Great variation in bucco-lingual diameter of upper molars; great variation in mesio-distal of lower molars. (*d*) Marked change in tooth pattern in lower molars, accompanied by reduction in number of cusps. Cusp patterns of lower molars show very wide departure from typical "Dryopithecus pattern" of ancient man (five cusps so related that base of mesio-lingual contacts base of buccal cusp). Teeth having four, five or six cusps occurred. Three distinct cusp-patterns in both four- and five-cusp teeth. Progressive variation in cusp-number and -pattern seems greatest in so-called civilized peoples. Reduction in crown size apparently caused by reduction in size of cusp or cusps, or elimination, in turn creating new patterns.

43. NEW CONCEPTS OF MERCURY CONTENT IN AMALGAMS. *Marcus L. Ward, D.D.Sc., F.A.C.D., Floyd A. Peyton, Sc.D., and Erman O. Scott, M.S., School of Dentistry, University of Michigan, Ann Arbor, Mich.* Report of continuation of work presented to I.A.D.R. in 1931 and 1935. Previous reports mentioned seven variables, which made amalgam specifications inoperative, and comprehensive comparison of data in different laboratories impossible. List of variables now thirteen, as follows: (a) Size and shape of mortar and pestle. (b) Roughness of mortar and pestle. (c) Pressure of pestle upon alloy in mortar. (d) Speed of pestle while mixing. (e) Speed and manner of mulling in hand. (f) Size and shape of particles. (g) Size of mass being mixed. (h) Age and condition of surfaces of

particles. (i) Percentage of mercury used to make plastic mass. (j) Time devoted to mixing in mortar and mulling in hand. (k) Removal of mercury during mulling in hand. (l) Packing pressure and effect upon mercury content. (m) Deferred packing and effect upon mercury content. Each variable affects volume changes and (most of them) flow of set amalgam. Analyses of set amalgams show different technics affect volume changes and flow by altering mercury content.

44. SUPPORTING STRUCTURES OF INCISOR TEETH OF GUINEA PIG IN EXPERIMENTAL SCURVY. *Paul E. Boyle, D.M.D., Dental and Medical Schools, Harvard University, Boston, Mass.* Scurvy so weakens peridental structures of guinea pig that incisor teeth become loose and easily extractable. X-ray and histological examinations reveal marked rarefaction of alveolar bone and widening of peridental membrane. Changes more conspicuous over labial enamel-covered part of incisors in region anterior to fulcrum of tooth. Paradentium of incisor teeth divisible, on basis of function, into cementum-covered suspending and enamel-covered cushioning portions. Cementum-covered tooth surfaces contain embedded collagen fibers: continuous with those of peridental membrane, uniting with fibers in alveolar bone. Forces of occlusion transmitted through cementum and peridental membrane to surrounding bone. Interwoven bundles of collagen fibers intermittently placed under tension, thus allowing limited movement of tooth resulting in slight alternating negative and positive pressures upon cushioning part of paradentium. In acute scurvy new collagen-fiber formation normally accompanying continuous eruption of tooth fails to occur. When suspending part of paradentium unable to withstand occlusal forces, these transmitted directly to cushioning part of paradentium resulting in alveolar atrophy described.

45. DEVELOPMENT OF TUMORS IN INCISOR TEETH OF RATS ON DIET LOW IN VITAMIN A. *Caspar G. Burn, M.D., Alvin W. Orten, M.S., and Arthur H. Smith, Ph.D., Medical School (Dental Study Unit), Yale University, New Haven, Conn.* Mild, chronic, vitamin-A deficiency produced in albino rats with minimum quantities of standardized oral dose of cod-liver oil. Amount of vitamin A given daily—0.7 to 8.0 International Units—determined for each rat by body

weight, appearance of eyes, snuffles and vaginal smear. Growth curves normal in shape, but absolute values slightly low. Most striking gross incisor changes in rats surviving 80 to 365 days: loss of color; distortion of shape, such as twisting, transverse and longitudinal ridging; eventual exfoliation of erupted portion; tumor formation. Histologically, changes compatible with those in complete vitamin-A deficiency. Tumor growths (odontomas) consisted chiefly of spindle-shaped cells similar to embryonic cells of pulp tissue. Inclusions of odontoblasts and epithelial cells distributed throughout tumor. Imperfect forms of germinal centers and osteodentinal structures frequently observed. Tumor not present in molar teeth. Supernumerary incisors occurred in several rats.

46. MULTIPLE EPITHELIAL CYSTS OF ALVEOLAR PROCESS IN NEWBORN INFANT. *Heyworth N. Sanford, M.D., and Harold J. Noyes, D.D.S., M.D., Presbyterian Hospital, Chicago, Ill.* White female infant having, immediately after birth, numerous raised gray nodules (diameter 1–2 mm.) studding alveolar process of both jaws. Mother, 24, healthy during pregnancy; delivery, normal. One previous pregnancy; abortion at two months. Lesions persisted throughout neonatal period—uneventful excepting very mild skin irritation. On fourteenth day small piece of tissue including one of nodules removed from mucus membrane of alveolar process in region of right upper temporary cuspid crypt; fixed in 10 percent formalin; embedded in celloidin; cut serially; stained with hematoxylin and eosin. Microscopic examination: several epithelial cysts; one of larger, ruptured through surface epithelium—spontaneous or caused by trauma of biopsy. One smaller cyst: similar opening. Structures lined with stratified squamous epithelium similar to that of oral mucosa; filled with cellular debris, blood cellular elements, and homogenous substance taking blue stain. No evidence of glands. Greater degree of degeneration in superficial layers of epithelial lining than in similar portion of surface epithelium. Serial sections demonstrate continuity of cyst lining with basal layer of oral epithelium. Suggest mechanism of formation due to isolation or semi-isolation of deeper epithelial cells by rapid proliferation of underlying connective tissue. Growth of both tissues extremely rapid (this age). Segregation of some active epithelial cells might produce condition. Central degeneration pro-

duces cyst. Process progresses along cord connecting or approaching surface epithelium. Lumen widens in direction of oral cavity, eventually rupturing externally with collapse of cyst; spontaneous resolution thus provided. At seven months, only few nodules remained over labial portion of crypts of upper deciduous cuspid teeth. Mucous membrane of lower jaw normal and two lower central incisors erupted. No treatment. (To be published in *Am. J. Dis. Child.*)

47. MAXILLARY FRENUM. *George M. Anderson, D.D.S., F.A.C.D., Dental School, University of Maryland, Baltimore, Md.* Superior labial frenum natural part of man, subject to variation in form, location and function. Does not normally extend between premaxillary bones. Surgically removed frenums: lamina propria composed of dense white fibres; no submucous layer, dense fibres blending with fibres of periosteum at bony attachment and with fibres of submucosa of lips at labial attachment. Fetal maxillae show attachment superficial, fibres not extending between premaxillae but dividing equally right and left side, joining superficially with fibres of periosteum and tunica propria of mucosa.

IX. FIFTH SESSION: AFTERNOON, MARCH 14; ABSTRACTS 48–62

48. HISTOLOGIC ANALYSIS OF CHILD'S JAWS IN MALOCCLUSION. *Rudolf Kronfeld, B.S., D.D.S., M.D., Foundation for Dental Research, Chicago College of Dental Surgery, Loyola University, Chicago, Ill.* Specimen: upper and lower jaws of child of 11. Upper right anterior teeth markedly crowded; upper right cuspid forced to erupt on labial side of arch. Anterior portion of upper jaw sectioned in horizontal plane, to facilitate study of position of roots of six anterior teeth. On left side, roots in normal alignment; bone and periodontal membrane normal. On right (crowded) side, space between central incisor and first bicuspid greatly reduced; apex of lateral incisor located on lingual side of root of cuspid—latter forced distally, as indicated by arrangement of bone on mesial side of root. Periodontal membrane on distal side of cuspid: very unusual enlargement and increase in number of blood vessels—tissue reaction described by Oppenheim as characteristic of periodontal membrane on pressure side of human teeth subjected to orthodontic treatment. (To be published in *Angle Orthodontist.*)

49. HISTOLOGICAL STUDIES ON OCCURRENCE AND NATURE OF FIBROUS ELEMENTS IN DENTAL GRANULOMATA. *M. W. McCrea, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* By use of Foot's modification of Hortega's silver ammonium carbonate stain for reticulum, occurrence and amount of reticulum studied in dental granulomata. Specimens ranged from thickened peridental membrane to root cyst. Capsule of granuloma and peridental membrane continuous; composed primarily of collagenous fibers. As inflammatory center develops, numerous blood capillaries appear in granulomata, and reticular fibers that make up supporting framework increase. Reticular fibers not collected into bundles like collagenous fibers of capsule and peridental membrane. Proliferated epithelial areas contain dense capillary network; also very dense reticular net. No reticular fibers in epithelium. As degeneration proceeds, area of necrosis loses reticular framework. Development of dense outer collagenous capsule and reticular net formation apparently efforts of periapical tissue to protect itself from irritation or inflammation—reticular fibers apparently transformed into collagenous fibers.

50. SYSTEMIC AND BLOOD-PICTURE FINDINGS IN SEVERAL HUNDRED PERICLASIA-FREE AND PERICLASIA-INVOLVED INDIVIDUALS. *Harold Goldstein, D.D.S., Dental School, University of Maryland, Baltimore, Md.* Series of 200 *periclasia-free* persons, aged 35 to 70, recorded for systemic diagnosis, blood pressure, hemoglobin, erythrocyte and leukocyte counts, and occupation. Same records made for 200 *periclasia-involved* cases, aged 30 to 70. Reports obtained from regular medical histories. *Findings:* (*a*) Diseases, such as diabetes, lues, gastro-intestinal ulcer and cancer, more frequent in periclasia-involved than in periclasia-free individuals. (*b*) Arthritis and cholecystitis more frequent in periclasia-free group. (*c*) Leukocyte counts (8,000 or over): higher in periclasia-involved group. (*d*) Hemoglobin and erythrocyte values generally same for both groups. (*e*) Blood pressure: greater number of periclasia-involved persons in lower blood-pressure brackets; greater number of periclasia-free persons in higher brackets. (*f*) Occupation: much lower incidence of peridental disease in persons engaged in "better occupations." (To be published in *J. Den. Res.*)

51. X-RAY CHANGES FOLLOWING TREATMENT OF OSTEOFIBROSIS. *Sidney Sorrin, D.D.S., College of Dentistry, New York University, New York City.* Case of osteofibrosis showing improvement after local therapy—occlusal equilibration. All systemic examinations negative. Biopsy of tissue about lower right cuspid tooth diagnosed as osteofibrosis. Teeth responded to normal vitality tests. Occlusion balanced and denture constructed. One year later, osteofibrosis areas improved, but new areas appeared. After further adjustment of denture, new areas disappeared. Denture utilized more teeth by securing greater reciprocal anchorage. Systemic examinations negative. Author indebted to Drs. Darlington, Schuyler, Swenson, Winter, Miller, Greenfield, Salman, Wald and Trapozzano for help and coöperation.

52. BIOLOGICAL AND MECHANICAL SIGNIFICANCE OF EPITHELIAL ATTACHMENT. *Edward H. Hatton, B.L., M.D., Northwestern University Dental School, Chicago, Ill.* Thin sections of unfixed and undecalcified teeth and investing tissues of young dogs, just after eruption of permanent teeth, obtained by grinding small blocks, frozen with dry ice on small microtome. Gingiva not mechanically attached to enamel surface—may be pushed from enamel with delicate, light wire without appreciable force, but returns promptly to position immediately adjacent to enamel. Such dyes as gentian violet and methylene blue—such fluids as India ink—do not penetrate layers between gums and enamel excepting as they diffuse through soft tissues. Enamel surfaces covered by gingival tissues do not decay. Even dentin overlaid by hyperplastic pulp hard and eburnated (arrested caries). Although mechanically epithelial attachment not important, biologically gingival tissue closely approximated to enamel very significant.

53. RELATIONSHIP BETWEEN VITAMINS AND ENDOCRINES, IN EFFECTS UPON TEETH AND BONY STRUCTURE. *M. T. Barrett, D.D.S., M.S., and H. Shubin, M.D., Philadelphia Institute for Medical Research, Philadelphia, Pa.* Projected study of relationship between all vitamins and all endocrine glands in biological processes, including dental caries and pathology of supporting structures of teeth. *Results (to date):* (*a*) Rats on *vitamin-A* deficiency diets, receiving anterior pituitary extract—(by x-ray) increased calcification of bones

and teeth, and presence of calculi in pelvis of kidney; same true to less extent with growth hormone alone. (*b*) No apparent relationship between *vitamin-B* and hormones of anterior pituitary gland. (*c*) Relationships of *vitamin-C* to glutathione and amino acids now being studied. (*d*) Rats on *vitamin-D* deficiency diet, receiving injections of whole-anterior-pituitary extract, showed marked fragility of supporting structure; definite dental caries in less than eight weeks. (*e*) Female rats on *vitamin-E* deficiency diets, receiving whole-anterior-pituitary extract, normal in weight; males, definitely dwarfed. (*f*) Rats receiving *glycine* (100 mg./day) had litters of markedly increased weight; moderate precocity of eruption of teeth and other organs. (*g*) Continuation of studies on *vitamin-C* deficiency, thymus extract and other hormones.

54. TEETH OF ANCIENT INDIANS OF PECOS PUEBLO. *C. T. Nelson, A.B., D.M.D., Dental School, Harvard University, Boston, Mass.; Department of Anthropology, Peabody Museum, Cambridge, Mass.* Study of skulls of 165 Indians living at Pueblo of Pecos, from A.D. 1100 to 1830, indicates larger teeth than in Modern Whites, but somewhat smaller than in Negroes and Negroids. Relatively small size and modified form of roots suggest arrested root development in Pecos teeth more pronounced than usual in non-European races. Indian teeth retained primitive and anthropoidal characteristics of crown patterns of lower molar teeth to greater extent than teeth of most present-day races. Abnormally high percentage (29.5%) of Pecos skulls exhibiting mesio-palatal torsion of maxillary central incisors suggests condition hereditary; otherwise, disturbances of occlusion relatively rare; periodontal disease and caries common. Approximately 36 percent of skulls show destructive degeneration of alveolar bone; 47 percent affected variably by caries.

55. "VITALITY" OF CALCIFIED DENTAL TISSUES. *Charles F. Bödecker, D.D.S., F.A.C.D., and William Lefkowitz, D.D.S., Dental School, Columbia University, New York City.* Authors believe physical and chemical changes in enamel and dentin representative of "vital" activity. Dental lymph previously defined by histological means (Bödecker). Presence shown by animal experiments similar to those of Fish and Bertram on 53 vital teeth of dogs, monkeys and man. *Dry* powdered dyes sealed in dentin (dog and man), 1–28

days; sections ground immediately in oil without fixing (watery fluids abstract coloring matter). Dyes passed throughout dentin along tubules in two directions, i.e., to pulp and to enamel; potassium permanganate reached surface. Dye limited principally to organized channels while pulp vital. Highest permeability in dog teeth; less successively in monkey and man. Permeability varies according to age of person and tooth, and conditions of dentin and pulp; different teeth in same mouth may vary. Flow of lymph shown best by young, healthy teeth; carious teeth completely unsuited. Removal of pulp and immediate placement of dye resulted in penetration of entire tooth of dog even to alveolus. Permeability diminishes slowly; old pulpless teeth far less permeable than vital ones. Presence of dental lymph in young teeth seems established. Marked increase of permeability in teeth with pulps recently removed over those having vital pulps, suggests pulp instrumental in regulating physical and chemical changes in dentin, enamel, and cementum. (To be published in *J. Den. Res.*)

56. APICES OF TEETH: CORRELATION OF BACTERIOLOGICAL, ROENTGENOLOGICAL AND GROSS ANATOMICAL FINDINGS IN HUMAN NECROPSIES. *Lester W. Burket, B.A., D.D.S., M.D., School of Medicine (Dental Study Unit), Yale University, New Haven, Conn.* Apices of 445 human teeth cultured by external-approach method, and bacteriological findings correlated with clinical condition of tooth and periapical radiolucent changes. Serial histological preparations permitted study of area and lesion cultured. Simultaneous blood and visceral cultures: for analysis with periapical results. Post-mortem conditions and material permitted aseptic bacteriological procedures; adequate number of non-carious teeth as controls. Streptococci recovered from 89 percent of teeth with positive periapical cultures—61 percent Str. viridans. Growth from 30 percent of periapically roentgenologically negative teeth—76 percent with small periapical radiolucent areas, 60 percent with large periapical radiolucent areas. Highest percentage of *pure* cultures from teeth showing no x-ray changes about apices; percentage of *mixed* cultures increased with development and increase in size of periapical radiolucent area. No characteristic bacteriological flora for any clinical or x-ray groupings. Correlation of periapical cultures impossible with amount of gingival

infection or degree of alveolar resorption (grossly pyorrhetic teeth not included). Correlation definite between roentgenological and bacteriological, and histological findings. How organisms reach periapical region of carious and non-carious teeth requires additional study, including amplified and refined bacteriological methods. (Published in *Yale J. Biol. and Med.*, 9: 271 and 347, 1937.)

57. CYSTIC STRUCTURES AND PECULIAR BONY PATTERN IN ANTERIOR MAXILLARY REGION. *Lester W. Burket, B.A., D.D.S., M.D., School of Medicine (Dental Study Unit), Yale University, New Haven, Conn.* Serial sections through midline of 35 adult human maxillae revealed cysts, or rudimentary naso-palatine duct-structures, in 21 and peculiar osseus pattern in 25. Clinical symptoms absent, but x-ray revealed numerous large or irregular anterior palatine foramina or fossae. Ducts often bilateral, and uninfected cysts, lined with ciliated columnar epithelium. Oral openings, lateral to small mass of hyaline cartilage, in palatine papilla. Four cysts infected. Bony changes restricted to anterior maxillary region; resembled Paget's disease of osteitis fibrosa. Dense inter-trabecular connective tissue contained numerous calcific deposits. No other epithelial rests noted. Probably cysts of palatine papilla result from cystic change of extra-osseous portions of naso-palatine duct, and anterior median cysts from intra-osseous portions of this structure, which persists in adult man. (Published in *Arch. Path.*, 6: 793, 1937.)

58. OBSERVATIONS ON pH OF SALIVA. *Louis I. Grossman, D.D.S., Dr. med. dent. (Rostock), and Bernard M. Brickman, D.D.S., Philadelphia, Pa.* Salivary pH of 56 persons studied with electrometric apparatus, including saturated calomel cell and Cullen quinhydrone electrode. Salivas (about 50% of subjects) studied hourly for 24 hours; 1,113 pH observations. To determine effect of eating: salivas obtained at 5-minute intervals, first half hour; at 15-minute intervals, remainder of hour; suitable controls. Findings of other investigators correlated with data obtained. *Results:* (*a*) pH range: 5.0 to 8.0. (*b*) pH level: varies for different people; fairly constant for same person. (*c*) Average diurnal pH: 6.5–6.9. (*d*) Nocturnal pH: lower than diurnal. (*e*) Drop in pH after eating; sometimes preceded by rise; return to normal level within hour. (To be published in *J. Den. Res.*)

59. IN VITRO EFFECT OF SALIVA ON BACTERIA. *J. L. T. Appleton, B.S., D.D.S., Sc.D., and Anne K. Dietz, Dental School, University of Pennsylvania, Philadelphia, Pa.* Inocula of various densities of *Serratia marcescens, Escherichia coli, Eberthella typhosa, Ps. aeruginosa,* seeded into human saliva; incubated at 37°C.; samples of mixtures taken at various times (1.5, 3, 6, 9, to 24 hours). Relative number of bacteria estimated in samples. Saliva from different individuals centrifuged; some sterilized by filtration; some heated at 56°C., 30 minutes; in some bacteria, removed by centrifugation, replaced after filtration or heating. All centrifuged saliva anti-bacterial. Filtered or heated, centrifuged saliva less anti-bacterial. Anti-bacterial effect apparently restored by returning bacteria separated by centrifuging.

60. EFFECT OF ORAL MUCOSA ON APPLIED BACTERIA. *J. L. T. Appleton, B.S., D.D.S., Sc.D., L.M. Gette, and C. Douglas, Dental School, University of Pennsylvania, Philadelphia, Pa.* Suspensions of *Escherichia coli* painted on areas of oral mucosa (lingual dorsum, hard palate, cheek, mucous surface of upper lip, external alveolar plate of maxillary anterior teeth). Swabbings, taken immediately and after 3 min. (from symmetrical area), transferred to surface of plates containing sterile gentian-violet agar. After 24 hrs. at 37°C. number of colonies from immediate and 3-minute swabbing compared. Results confirmed work of Arnold *et al.*: oral mucosa somewhat bacteria-fixing or anti-bacterial, analogous to action of skin. Different areas of oral mucosa varied in frequency of effects. Smaller series, substituting *Serratia marcescens* for *E. coli*: similar results.

61. EFFECT OF SALIVA ON GROWTH OF BACTERIA. *Basil G. Bibby, B.D.S., Ph.D., and Rita P. Ball, School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Graded inocula mixed in agar-pour cultures; plated; saliva added to wells cut in hardened agar. Growth-inhibitory effects manifested as colony-free zones about wells. Study included 17 types of bacteria; 117 strains. Each type subjected to action of at least four different salivas. General bacteriostatic effects: marked action against organisms not usually present in mouth; slight or absent against organisms normally present.

62. BACTERIOSTATIC AGENTS IN HUMAN SALIVA. *Basil G. Bibby, B.D.S., Ph.D., School of Medicine and Dentistry, University of Roches-*

ter, Rochester, N. Y. Properties of salivary anti-bacterial-agents, effective against selected types of bacteria, compared to determine whether any agent responsible for effects manifested, and whether identical with lysozyme of egg white—used as basis for comparison because of ready availability. All anti-bacterial agents resisted storage at refrigerator and incubator temperatures, 5–15 days. Inability of salivary anti-lysodeikticus agent to pass Berkefeld-N filter, and resistance to boiling, set it apart from lysozyme and salivary agents effective against other organisms. Latter agents: appear in Berkefeld-N filtrates after filtering 10 or 15 cc. of saliva; destroyed at temperatures above 80°C. Salivary anti-lysodeikticus agent resembled lysozyme in solubility in 0.8 percent NaCl, and ability to induce lysis of suspensions of organisms—properties shared by no other salivary anti-bacterial-agent. *Conclusions:* Apparently no anti-bacterial agent in saliva identical with lysozyme of egg white; at least two anti-bacterial agents in saliva.

X. Sixth Session: Evening, March 14; Abstracts 63–74

A. Greetings from representatives of dental organizations: abstracts 63–70

63. University of Maryland. *H. C. Byrd, B.S., President, College Park, Md.* "Nothing should give one greater pleasure than to extend a brief word of greeting to the men whose search for new knowledge is, and will continue to be, the backbone of progress in the field of dental education and practice. To stand in your midst and listen to what you have achieved, and to hear of your hopes for the future, is an inspiration; and my hope is that the University of Maryland and other universities always will be in a position to give you the support that you deserve. You are contributing to the effort of mankind toward the goal of better health, and the progress toward this goal should, to a great extent, be measured by what you achieve; and what you achieve should, in turn, be measured by the support that is forthcoming from those of us who are in the administrative side of university life. In the University of Maryland we hope to make, through research, a very substantial contribution toward dental education, in the belief that in this way we shall be doing our part in the effort to achieve a greater state of happiness and content-

ment for mankind. On behalf of the Board of Regents of the University, of the Faculty, and officially and personally, I extend to you greetings and best wishes."

64. UNIVERSITY OF MARYLAND, SCHOOL OF DENTISTRY—BALTIMORE COLLEGE OF DENTAL SURGERY. *J. Ben Robinson, D.D.S., F.A.C.D., Dean.* "It is fitting that the International Association for Dental Research should hold its fifteenth general meeting in Baltimore; it would be most appropriate for it to make this city its meeting place for any anniversary. Among its many firsts, Baltimore claims the honor of having given to American dentistry its first serious researcher. Only a few yards to the northeast of us, diagonally across the block from this meeting place, is the site of the building where Horace H. Hayden began the practice of dentistry. From the beginning, continuing to the end of an unusual career of service, he was venturing into the unknown, diligently attempting to push back the boundaries of scientific knowledge. From our present position his efforts appear modest and his contributions of small consequence, but we should respect him for his successful effort to solve many difficult problems of importance that gave to the infant dental profession a sound purpose and an intelligent direction.

"But there is a reason of more human interest why the International Association for Dental Research might desire to make Baltimore and its environs the mecca to which its future generations would return. That you may better grasp my meaning I would have you go with me on a journey to the country northwest of this great city. Starting at this point I would take you by several historical places where you might catch a glimpse of the worthy past of this great city; out through a beautiful residential section that is the pride of our people; on into a rich country of wide spreading meadows, of abundant harvest fields, of fruit-laden orchards, of cool shady groves pleasingly distributed over a strikingly beautiful country-side. As we journey on we approach the foot-hills of the western part of our State, where we come upon a quiet but flourishing community, Reisterstown. A place now too large to be classed as a village, too small to be called a city; a community of substantial homes, lovely streets, prosperous business houses, and of a rugged population that has contributed more than its share to the fine traditions of Maryland.

An humble home, in this inconspicuous community, deserves to be regarded as the shrine of the International Association for Dental Research. *It was the birthplace of William J. Gies.*

"No man in the history of American dentistry has contributed more to its culture and to its solidarity than has this friend; no one has shown a keener interest in it or a more sympathetic understanding of its needs than he; no one has sacrificed more to nourish it nor demonstrated greater courage in protecting it than this strangely found champion. To him we are indebted for wise guidance and aggressive leadership; to him may be given the credit for an inspiration and a determination that have sent us forward and upward; to him should go the credit for piloting our great profession through the most critical period in its history. He is one of dentistry's greatest benefactors, now occupying a place in American dentistry second only to the great Horace H. Hayden, if second even to him. Maryland is signally honored that it should have given to pioneer dentistry the direction and leadership of Hayden; and to modern dentistry the idealism, the enthusiasm and culture of Gies."

65. MARYLAND STATE DENTAL ASSOCIATION. *A. Y. Russell, D.D.S., President; Baltimore, Md.* The speaker indicated hearty interest in the advancement of dental research and in the growth of the Research Association. He cordially welcomed the Association to Baltimore, and invited all to attend the next annual meeting of the Maryland State Dental Association.

66. BALTIMORE CITY DENTAL SOCIETY. *Morris Cramer, D.D.S., President.* The speaker expressed appreciation of the opportunity to address the Association, considering it "a real privilege and an honor." He was happy, representing the Baltimore City Dental Society, to "extend most cordial greetings to all." "The members of this Association," he said, "have done much for our profession. They deserve a great deal of the credit for the progress that dentistry has made and the scientific knowledge it has gained through research during the past few years. The members of the dental profession in Baltimore feel very proud to be hosts to men of such caliber. We hope that you will again give us the same privilege and pleasure in the near future."

67. MARYLAND STATE BOARD OF DENTAL EXAMINERS. *B. Lucien*

Brun, D.D.S., F.A.C.D., President; Baltimore, Md. The speaker, for himself and his official colleagues, accorded the Association a hearty welcome to Baltimore. The President of the Maryland State Board of Dental Examiners, "in harmony with prevailing habits in terminology, referred to the dental profession alphabetically as the 'S.S.S.,' i.e., *Societies, Schools and Statutes*. This trinity of enterprises comprehends the basic functions of professional integrity and progress, literature, research, and other cultural adjuncts being but the tools of the three main forces. While these three are independent, they also are interdependent, and sound progress can come only from the correlation and substantial advancement of the interests of all. From this point of view—the importance of more effective coördination—there seems to have been too much aloofness in the attitudes of these three factors and too much divergence of thought in directing them. A closer knit correlation of their fortunes will be of great benefit to the dental profession. Their activities may be compared to physical forces operating to move a load, with a resultant which represents the actual good that is being done. If such forces act in opposite directions, or along divergent lines, upon a mass, the ensuing effects are minimized; whereas, if they operate in parallel directions, or pull together, the maximum effects (efficiency) result—and the greatest good is achieved."

68. RESEARCH COMMISSION, AMERICAN DENTAL ASSOCIATION. *Harry E. Kelsey, D.D.S., F.A.C.D., Secretary; Baltimore, Md.* "Both as a Baltimorean and a member of this Association, I, with other local members, greet you most cordially and trust you are thoroughly enjoying this period of relaxation, after the rather intense concentration of the last two days on what we hope will prove to be one of the most outstanding and valuable series of contributions to dental research. We hope that, in spite of the close attention which members of the organization always give to the program, you have had at least a little time to enjoy such places of interest as our city and state afford, and that you have not found absent the cordial hospitality for which we like to believe we are noted. As Secretary of the Research Commission of the American Dental Association, I also wish to express to you the good will of the Commission and all of its members. During the last year or so, the American Dental Association

and the Research Commission have had, as some of you may know, a closer relationship with the International Association for Dental Research and its *Journal* than previously existed. I feel certain it will be to the general advantage, since almost all of the members of this organization are also members of the American Dental Association."

69. AMERICAN ASSOCIATION OF DENTAL SCHOOLS. *Ralph R. Byrnes, D.D.S., F.A.C.D., President; Dean, Atlanta-Southern Dental College, Atlanta, Ga.* "It is a real pleasure to be here tonight, to enjoy the splendid fellowship of such a genuinely worthwhile organization. I have seen this Association grow from its inception. I don't know of any one person to whom the success of such a splendid movement and scientific effort can be attributed entirely. If such a thing were possible, however, our honored friend, Dr. Gies, would, in my humble estimation, be that person. Your Association is doing a splendid work, and its correlation with that of the profession of dentistry seems to be well-nigh perfect. As President of the American Association of Dental Schools I bring you greetings from that body, and wish you the continued success which your earnest interest and sincere application so richly deserve."

70. AMERICAN DENTAL ASSOCIATION. *L. M. S. Miner, D.M.D., M.D., Sc.D., F.A.C.D., President; Dean, Dental School, Harvard University, Boston, Mass.* "It has been said that any profession whose foundation rests on the biological and physical sciences advances in proportion to the quality and quantity of its research work. If this is only partly true, any organization, like the American Dental Association, which represents the profession as a whole, should be interested *in* research and in an organization whose primary concern *is* research—as is the case of the International Association for Dental Research. And so, it is a special privilege and an honor, in view of my past relationship with the International Association, to bring the greetings of the American Dental Association, as its President. The American Dental Association has its Research Commission, through which the Association expends each year funds to promote the interests of research. At San Francisco $600.00 was voted towards the support of the *Journal of Dental Research.* This is as it should be, but there is another aspect of the whole situation which it seems

to me has possibilities for this work; namely, that the members of this Association should take an active interest in the Research Commission, helping by their support and advice the activities of this important committee. The closer the collaboration between the members of the International Association for Dental Research and the Research Commission of the American Dental Association, the sounder will be our approach to the problem of dental research."

B. GENERAL ADDRESS: ABSTRACT 71

71. NUTRITION AND DENTITION. *E. V. McCollum, M.A., Ph.D., Sc.D., School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.* "Notwithstanding there are still differences of view among research workers concerning the etiology of dental caries, there is unanimity of opinion that most, if not all, of the specific effects of diet on tooth development are known, at least in the qualitative sense. The ameloblasts are of ectodermal origin, and are, accordingly, specially sensitive to even mild deficiency of vitamin A. It is clear that even though the blood may be of normal composition as respects calcium- and phosphate-ion concentrations, the ameloblasts will lay down hypoplastic enamel if they are deprived of vitamin A to a degree which would cause incipient morphological changes of the keratinizing type. On the other hand, if the ameloblasts are normal functionally they cannot deposit perfect enamel unless the blood calcium- and phosphate-ions are present in normal concentration. The phosphate-ion concentration of the blood is profoundly influenced by deficiency of vitamin D; hence the importance of this nutrient in tooth development. As respects dentin, there is a primary significance of vitamin C, since the odontoblasts are peculiarly sensitive to even mild deprivation of this substance. Deficiency of vitamin C, even to the extent of inducing only a sub-clinical scorbutic state, may be expected to induce the laying down of hypoplastic dentin. But the deposition of normal dentin is just as dependent upon a normal concentration, in the blood, of calcium- and phospate-ions as are the bones and enamel. Hence vitamin D plays an essential role in tooth development. In order to insure normal tooth development, these dietary factors deserve special consideration in the planning of the diet of the child."

C. OFFICIAL ADDRESSES: 72–74

72. PRESIDENTIAL ADDRESS. *William G. Skillen, D.D.S., Dental School, Northwestern University, Chicago, Ill.* (Pages 290–294)

73. INTRODUCTION OF PRESIDENT-ELECT, *by George C. Paffenbarger, D.D.S., F.A.C.D., National Bureau of Standards, Washington, D. C.* (Pages 294–295)

74. INAUGURAL ADDRESS. *Paul C. Kitchin, B.S., M.S., D.D.S., F.A.C.D., Dental School, Ohio State University, Columbus, Ohio.* (Pages 295–297)

[Concluding executive proceedings followed: page 360.]

XI. PAPERS READ BY TITLE: ABSTRACTS 75–125

A. CONTRIBUTIONS BY BUDAPEST SECTION: ABSTRACTS 75–82

75. METHOD FOR MEASURING PENETRATION OF ACIDS INTO ENAMEL. *Pál Hoff, M.D., and Ferenc Köszeg, M.D., Dental Department, Count Albert Apponyi Polyclinic (Director, Docent Géza de Lobmayer), Budapest, Hungary.* Decay begins with dissolution of enamel. Enright, Friesell and Trescher (*J. Den. Res., 12:* 759, 1932) showed photomicrographs of acid-treated teeth closely resembling conditions of decay. Quantitative evaluation of such observations necessary to ascertain influence of variations in caries susceptibility of individual teeth, dental surfaces, etc. Authors, by new accurate method (micrometer apparatus), obtained significant results. *Preliminary findings:* Enamel of freshly extracted teeth dissolved in all buffers (lactic acid-sodium lactate) in pH range 3–4.5; very slowly at acidities less than pH 4.5. Individual variations: marked at low acidities; no present explanation.

76. MINERAL METABOLISM FROM DENTAL POINT OF VIEW. *Andrew Klinger, M.D., Stomatological Clinic (Director, Dr. József Szabó), Royal Hungarian Pázmány Péter University, Budapest, Hungary.* Dental histology and morphogenesis based on connections and analogies between dental and osseous systems. Biochemistry also essential in dental pathology and preventive dentistry to explain origin of, and to prescribe therapy for, dental disease. Numerous aspects of related problems discussed in terms of current procedures. (To be published in *Fogorvosi Szemle.*)

77. ROOT-CANAL TREATMENT BY ELECTRO-STERILIZATION. *István Makovényi, M.D., Stomatological Clinic (Director, Dr. József Szabó), Royal Hungarian Pázmány Péter University, Budapest, Hungary.* Despite progress of Prinz and coworkers in conservative treatment of infected root-canals, many practitioners in United States reject it. Author outlined method for "efficacious conservative root-canal treatment." Diathermic treatment of infected root-canals successful where extraction not absolutely necessary (point of view of whole organism) and clinical state of periodontal tissue (abscess, granuloma) favorable. *Author's technique:* After roentgenogram, trepanation of infected pulp chamber; treatment delayed until symptoms of acute inflammation disappear. After widening root canals to apex—Kerr reamers and root-canal files, and rinsing with H_2O_2 and chloramine—tooth isolated and root canals sterilized with diathermic current, in one treatment with current of 40–60 ma. applied thrice, 5–6 seconds each time, at 10-second intervals. After complete exsiccation with sterile paper-points, mixture of easily flowing cement and iodoform pumped into canals; then filled with guttapercha points—narrow or contorted root-canals, with silver points. Results checked with roentgenograms immediately after treatment; again in 6 months or 1 year. Periodontal sensibility about treated teeth occasionally for short period. Ossification of periapical region should be evident in second roentgenogram. In 1–2 weeks after treatment, tooth available for bridge work—crowning, etc. Advantages of treatment, besides simplicity: rapid healing of gangrenous teeth in most cases; conservative treatment possible without apicotomy—nightmare for timid patients.

78. COMPARISON OF RESULTS OBTAINED WITH TELEOROENTGENOGRAPHY (SYSTEM SIMON-REHÁK) AND ANTHROPOLOGICAL MEASUREMENTS. *Rudolf Rehák, M.D., Dental Department, Count Albert Apponyi Polyclinic (Director, Docent Géza de Lobmayer), Budapest, Hungary.* Skull, subjected to exact anthropological survey, photographed by two-film x-ray method and results compared. Maximum deviation between direct and indirect methods not more than 7 percent. From orthodontic standpoint result satisfactory. Real symmetry not human characteristic. *Useful suggestion for teleoroentgenography:* Mark tragion-orbitale plane (Horizontal of Franfurt)

with lead-wire, and attach needle of known length to orbital-point vertically to horizontal-plane and median line. Needle then marks orbital-plane.

79. VARIATIONS IN SIZE AND POSITION OF MANDIBULAR RAMUS, WITH SPECIAL REFERENCE TO MANDIBULAR BLOCK ANESTHESIA. *Béla de Simon, M.D., and Oszkár Kömives, Dental Department, Count Albert Apponyi Polyclinic (Director, Docent Géza de Lobmayer), Budapest, Hungary.* Several technics of linguo-alveolar inferior nerve block-anesthesia described since Fischer's original communication. Occasional unavoidable failures with any injection technic, owing to different recommendations for direction of syringe and needle; points of entrance; depths of penetration. To compare dimensional variations of mandibles as possible explanation of some failures, 750 mandibles measured exactly, and averages and deviations recorded—500 mandibles comparatively homogeneous remainders from old cemetery in Budapest; 250 internationally collected, partly colored or exotic. Metric variations so great, generally acceptable metric rule for injection impossible; satisfactory results dependent on thorough anatomical knowledge and individual considerations. *Summary:* Width of ramus varied between 20.8–44 mm. All methods prescribing depth of needle-point penetration open to failure in two ways: solution may not reach pterygo-mandibular space where ramus broader than average; or, for narrow ramus, solution may be injected into substance of parotid gland, with ensuing paralysis of facial nerve. Depth of penetration must be adapted to individual case. Diameter of ramus easily measured—approximately at least—by placing thumb on margin of ramus intraorally and index finger on posterior border extraorally, ramus being held between fingers. Angle between median line and ascending ramus varies between 0–27 degrees. Impossible often to advance with needle in contact with bone. Needle, closing very pointed angle with bone, scratches periosteum or breaks. Observation of facial configuration of individual allows sufficient estimation of angle. Lingula usually described as occupying middle of length of ramus, but position varies up and down. In only about 50 percent of cases lingula in expected position; in over 33 percent higher; in the rest deeper. In 33-percent group, failure occurs with injection at height of lower masticating surfaces—solu-

tion reaches not lingula, but only fibers of pterygoid muscle. Injection midway between upper and lower masticating surfaces (Lewitt and Schleich) preferable. Foregoing numerical values changeable by more extended examinations, but necessity in anesthesia for consideration of individual variations demonstrated.

80. MANDIBLE IN MOUSTERIAN MAN IN GROTTO MUSSOLINI (HUNGARY). *József Szabó, M.D., Stomatological Clinic, Royal Hungarian Pázmány Péter University, Budapest, Hungary.* [Published in *Proc. Soc. Anthrop. Paris*, 1935.]

81. PARADENTOSIS PROBLEM (PYORRHEA) FROM STANDPOINT OF GENERAL MEDICINE. *József Szabó, M.D., Stomatological Clinic, Royal Hungarian Pázmány Péter University, Budapest, Hungary.* [Published in *Med. Klin.*, 1936; pp. 1621, 1661.]

82. BONE MEASUREMENTS ON MANDIBLE. *Béla Szokolóczy-Syllaba, M.D., Stomatological Clinic (Director, Dr. József Szabó), Royal Hungarian Pázmány Péter University, Budapest, Hungary.* Author's method for intraoral block-anesthesia of inferior alveolar nerve published in Stomatological Clinic's Memorial Volume, 1933. Recently variations in width and deflection of ascending ramus relative to body of mandible observed. To establish reliable basis for ensuing necessary changes in injection technique, bone measurements on mandible required. With aid of goniometer, following results obtained in study of 105 (skeleton) mandibles: (*a*) Deflection of ascending ramus varied from 2 to 18°; median, 10. (*b*) Breadth of ascending ramus, from torus verticalis (Lenhossék)—crista temporalis mandibulae—to posterior edge of ascending ramus in lingula's height varied from 22 to 33 mm.; median, 27. (*c*) Distance of mandibular foramen from inferior edge of mandible varied between 17 and 37 mm.; median, 24. (*d*) Mandibular foramen: midway between torus verticalis (crista temporalis mandibulae) and posterior edge of ascending ramus. *Conclusion* relative to intraoral nerve-block anesthesia: Wide individual variations, not evident from intraoral conditions alone, require special attention in each case.

B. CONTRIBUTIONS BY VIENNA SECTION: ABSTRACTS 83–99

83. FUNDAMENTALS IN SYMMETRY EXAMINATION OF JAWS. *A. Biro, M.D., and P. Adler, M.D., Dental Department (Director, Doz. Dr.*

O. Hofer), *Polyclinic, Vienna, Austria.* Symmetry test of jaws and teeth basis of all orthodontic diagnosis since Grünberg founded science of reconstruction. In measuring transverse asymmetries, models must be positioned along *sagittal symmetry axis.* Anatomical symmetry axis of maxilla: raphe, posterior portion projected into occlusal plane—straight line (Koerbitz). Most transverse asymmetries, assumed as unimportant, ignored by Grünberg, who positioned models otherwise in measuring sagittal asymmetries of alignment of teeth (basis of reconstruction). His theoretical foundation of positioning: hypothesis on constancy in position of upper first molars. In Grünberg's positioning, angle formed by tangents from positioning points bisected by line (position line, according to Grünberg; "geometric middle of jaw") passing between central incisors. Some authors returned to positioning along raphe (Korkhaus); some position models by other principles. Schwarz denotes positioning line "true middle of jaw," yet paradoxically measures asymmetries of breadth by starting from true middle. Present authors tried to transfer median sagittal axis of face ("middle of face") to models, with pair of tripartite orthodontic measuring compasses. Third branch, moveable laterally and revolvable, added to branches of ordinary orthodontic measuring compasses—set by gauging on marked "middle of face" and fixing with screw. With compasses "middle of face" transferred to model of maxilla, and thence, if necessary, to model of mandible. Line thus determined on model called "sagittal symmetry axis." Practical effects of changed positioning of symmetry described later. To avoid parallactic errors in reading symmetroscopes, authors recommend "reading by means of mirror," for decades most reliable in use of precision measuring instruments. (Published in *Prakt. Zahnarzt., 5:* 37, 1937.)

84. INFLUENCE OF ELECTRIC SHORT WAVES ON SYMPATHETIC NERVOUS SYSTEM. *Karl Breitner, M.D., Vienna, Austria.* Influence, described by Pflomm and others, on vascular nerves (dilators) in frog tongue, during and after application of short-waves, tested on human beings and mammals. Desirable to ascertain, for dentistry, whether narrowing of vessels by adrenalin annulled in man by application of short-waves. (*a*) Of 4 percent solution of novocain (Hoechst), 0.5 cc. injected on under-lip beneath mucous membrane; anesthesia lasted uniformly 30 minutes. (*b*) In same place injected

0.5 cc. of 4 percent solution of novocain, containing adrenalin (3 drops of 1:1000 in 10 cc.); anesthesia lasted uniformly 2 hours. (*c*) In same place also injected 0.5 cc. of same solution of novocain containing adrenalin, followed by application of short-waves—6 *m*—for 12 minutes; anesthesia lasted uniformly 2 hours, as in second series. Similar tests also failed in dogs. *Conclusion:* 6 *m* waves did not exert direct influence on sympathetic nervous system.

85. NEW METHOD OF PLEXUS-ANESTHESIA IN UPPER JAW. *Fritz Driak, M.D., Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* Local anesthesia in upper jaw, with usual method of injecting into fold of mucous membrane of cheek (vestibular-subperiosteal depot) to obtain anesthesia of incisors and premolars, sometimes fails. Submucous tissue, more profuse higher up, allows dispersion (progressive division) of anesthetic solution. When puncture for vestibular injection placed too high, anesthetic solution withdraws from bone and root-apices. Author sought technic to keep depot close to bone. Advantageous to insert needle little above line between fixed and movable mucous membranes, and advance at once horizontally and parallel to processus alveolaris. Thus ribbon-shaped depot producible in any desired extension—also reliable anesthesia of upper incisors, premolars, and first molars. Results for 100 extractions summarized below:

Anesthesia for:	*Cases:* no.	*Complete success:* no. of cases	*Failure:* no. of cases
Upper incisors	22	22	0
Upper premolars	36	36	0
Upper first molars	42	40	2

Success of method almost perfect, failure for each of two molars due to abnormally developed crista zygomatico-alveolaris. For canines and second and third molars, more reliable to anesthetize by usual local method, but higher up; or to use conductive anesthesia.

86. CASE OF FRACTURES OF CEMENTUM. *Richard Grohs, M.D., Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* (No manuscript for publication.)

87. CATAPHORESIS IN ROOT-CANAL TREATMENT. *Ernst Kellner, M.D., Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* (No manuscript for publication.)

88. MEASURES TO PROTECT JAWS AND TEETH FROM FRACTURES IN SPORT INJURIES. *Edmund Kerpel, M.D., Vienna, Austria.* Jaw fractures, dislocations, loss of anterior teeth, and disfiguring injuries of oral soft parts—common in sports—require not only treatment and restoration, but also best possible prophylaxis against sequelae. Boxing presents frequent occasions for ministrations of dental specialist, face and maxillary and oral parts being primary offensive objectives of contestants. Author's "*defensor*" *splints*, constructed for protection against sport traumata: soft rubber splints having special steel springs; set over dental arches, extend above and below to fornix of gingivae. *In forced occlusion, maxilla and mandible form massive block protected by inserted rubber splint;* hardest blows against dental row, mandible and maxilla nullified; inversion of lips prevented—often badly cut in this position, especially in beginners; dislocation of temporo-maxillary joint made very difficult; danger of fracture of base of skull, by counter-blow against jaw and glenoidal cavity, greatly reduced.

89. ELECTRIC RESISTANCE OF DENTIN. *Hermann Mathis, M.D., and Peter Adler, M.D., Institute of Physiology (Director, Prof. Dr. A. Durig), and Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* Electric resistance to alternate current, 50 periods, determined in small pieces of dentin from recently extracted teeth kept as nearly natural as possible. Measurements: tension in circuit (shunt voltmeter) and actual current intensity (milliamperemeter, directly indicating 0.01 mA, in principal circuit). Resulting values: actual resistance of tested dentin fragments calculated; then recalculated for dentin die (1 cc.) corresponding to dimensions of dentin fragment (specific resistance). Dentin fragments from teeth having inflamed or necrotic pulps: resistance varied from 100,000 to 2,000,000 ohms. In some fragments, no measurable current when tension of 110 volts applied. Resistances of individual fragments varied with direction of application of current. Results demonstrate direct current not as useful for root-canal treatment as believed because, owing to high resistance of dentin, amount of current passing through dentin walls of canal insufficient for sterilization.

90. DEPARTMENT FOR MAXILLARY DISEASES, FIRST SURGICAL CLINIC, VIENNA; DEVELOPMENT AND FIELD OF ACTIVITY. *Hans Pichler, M.D.,*

and Otto Hofer, M.D., Dental Institute, University of Vienna, Vienna, Austria. Department, one of latest additions to Vienna General Hospital (Wiener Allgemeines Krankenhaus), created in 1914 for war-time emergency service. Owing to cumulative value in medical and dental care, continued and steadily developed as peace-time surgical agency. Exceptional growth and utility indicated by increase in number of ambulatory patients per year: from 669 in 1918 to 12,601 in 1934 (10,480 in 1935; 12,062 in 1936). Paper describes many fields and procedures in Department's widely varied work; indicates need for similar health service in all large centers of population. (To be published in *Ann. Den.*)

91. RADIOGRAPHIC EVIDENCE OF SUPERNUMERARY ROOTS: ANATOMIC DIAGNOSIS AND CLINICAL SIGNIFICANCE. *L. Pohl, M.D., Dental Department (Director, Doz. Dr. O. Hofer), Polyclinic, Vienna, Austria.* (No manuscript for publication.)

92. PREPARATION OF STEP FOR JACKET CROWN. *Otto Preissecker, M.D., Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* (No manuscript for publication.)

93. RADIOGRAPHIC LOCALIZATION OF RESIDUAL ROOTS OR SMALL SEQUESTRA. *F. Schiller, M.D., Vienna, Austria.* (No manuscript for publication.)

94. HISTOLOGICAL DATA IN OSTEOMYELITIS OF JAW. *Franz Schönbauer, M.D., Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* (No manuscript for publication.)

95. PHYLOGENESIS OF HUMAN TEMPOROMANDIBULAR ARTICULATION. *Harry Sicher, M.D., Vienna, Austria.* Combined rotating-sliding movement of lower jaw in opening mouth quality peculiar to man. In Vienna Zoological Garden, adult female chimpanzee (nearest relative of man) opens mouth by rotating lower jaw, sliding movement being used only in mastication, in main unilaterally. Acquisition of peculiar movement of human jaw caused by narrowing of space back of temporomandibular articulation, owing to bending off of base of skull and development of mastoid process. During opening of mouth, narrowing of retromandibular fossa causes compression of soft tissues between posterior border of mandibular ramus and mastoid process, opening in rotating movement then being limited to two-thirds of normal width at most. By practice one can learn to open mouth

by rotating movement alone, and feel at first narrowing and then expanding of retromandibular fossa at moment when lower jaw slides forward, and mouth opens to maximal width. Acquired combined movements caused development of articular eminence on temporal bone—another specific human feature. Attendant change occurred on inner surface of ascending ramus of mandible. So long as movement of lower jaw only rotational, every point revolves around axis in circular arc, and distance of any given point from axis remains same during whole opening movement. In chimpanzee, mandibular nerve and mylohyoid nerve, for example, enter bone at points some distance apart. Through acquisition in man of rotating-sliding movement, said equality of different points on inner surface of lower jaw ceases; only *one* point relatively at rest during this movement—mandibular foramen, point where mandibular nerve enters mandibular canal and mylohyoid nerve enters mylohyoid groove. Points of entrance, formerly distant, now united in one; tension there during movement minimal. When articular eminence occurs on temporal bone: *combined* rotating and sliding (human) movements of lower jaw in opening mouth. With separate entrances of mandibular and mylohyoid nerves into bone: only rotating movement of lower jaw in opening mouth. *Application:* Whether Piltdown remains (parts of skull and almost half of lower jaw) belong to one individual or two, still open question. Some authors, believing parts belong together, accept genus "Eoanthropus Dawsoni." Others believe skull human and modern, and mandible from chimpanzee. Conditions outlined above present definite evidence. Temporal bone of Piltdown skull has well-developed articular eminence, showing living individual opened mouth by *combined rotating and sliding movements* of lower jaw. On inner surface of Piltdown mandible, mylohyoid groove begins far from mandibular foramen, and living individual—two distinct and distant entrances for two nerves mentioned above—opened mouth by *rotating* movement. Piltdown skull and mandible not from one individual.

96. REPLANTATION OF DECIDUOUS TEETH. *Georg Stein, M.D., Dental Department (Director Dr. Georg Stein), First Institute for Treatment of Children (Director, Dr. Karl Hochsinger), Vienna, Austria.* Possible usefulness of replantation of deciduous teeth, especially as

space retainers, studied experimentally with aid of Drs. Brückner and Fleischmann. Procedures and preliminary results: Necrotic deciduous tooth extracted (local anesthesia) with precautions to minimize damage to gums and bone. Pulp canals widened and disinfected; filled with phosphate cement mixed with dentin powder and thymol. Tooth having lain for 30 minutes in Pregl's iodine solution, roots shortened, extraction-wound sprayed with Pregl solution to remove blood-clot, and tooth replanted. Roots, if markedly divergent, trimmed sufficiently for insertion of tooth into alveolus. Tooth, ground out of articulation, held in place by small fixation apparatus (soldered union of bands III, IV, V). In one case apparatus not applied, tooth holding firmly without; but only case in which replanted tooth removed (two days after replantation); rose too far above occlusal plane to be ground out of articulation. All other teeth (25) "healed" without special discomfort. Most cases: neither pain nor swelling next day. A few: slight swelling but no severe pain. Of 17 replanted teeth, under observation for *over three months*: 5 firm as normal deciduous teeth; 6, although loose to moderate degree, in good function; 1 very loose; 5 not reexamined. Six months after replantation, one tooth lost, root almost completely resorbed. Bifurcation frequently free on buccal side. Authors unable to say replanted deciduous teeth will hold until eruption of first permanent molars, but in most cases function very satisfactorily. To insure space retention until permanent molars erupt, Dr. Thalhammer suggested introduction (with fixation apparatus) of "Pontopin" root into alveolus of extracted deciduous molar, and now conducting related experiments in this Institute.

97. TREATMENT OF POST-EXTRACTIVE PAIN. *Richard Trauner, M.D., Vienna, Austria.* To mitigate pain after extraction, two methods of local treatment, besides cleaning and disinfection of dry socket, now used: (a) phenolcamphor, orthoform, eugenol, or mixture of several drugs, placed into socket; (b) less frequently, bone etched superficially with concentrated carbolic acid, silver nitrate, or trichloracetic acid. In each treatment, socket filled with gauze; changed every few days. In author's experience pain-relieving drugs act quickly, but frequently pain returns during or after first day—remedy washed out by saliva through gauze. After "etching," pain some-

times continues several hours, then usually disappears. To avoid changing gauze, always rather painful, but chiefly to prevent entrance of saliva and food into socket and ensuing irritation of hypersensitive nerves, author recommends use of gauze carrying adhesive (containing acetone) that clings to socket wall even if not quite dry. Gauze becomes stiff; may be left in place for 8–10 days, until end of period for recurrence of pain. Acetone: antiseptic. Beneath this gauze, in apical region of socket, may be put pain-relieving drug that cannot be washed out by saliva; in severe cases, socket also etched. Proposed treatments: applied under local anesthesia; saliva excluded for 15 minutes. In 54 of 72 cases post-extractive pains removed with one application; 12 cases needed a second or third. In 6, pains mitigated, not stopped—all cases of so-called neuritis of mandibular nerve. When adequate blood-clot fails to form after extraction, socket may be treated at once as proposed. Recommended acetone-containing adhesive obtainable from any druggist; marketed as "Cohesan," etc.

98. FOURTH MOLAR IN LEFT MANDIBLE. *Rudolf Ullik, M.D., Dental Department (Director, Doz. Dr. O. Hofer), Polyclinic, Vienna, Austria.* Lower left fourth molar discovered in radiograph of patient suffering from difficult left dentition. By direct oral examination mesial portion of crown of third molar visible; distal covered by inflamed mucous membrane. In probing deep pocket, supernumerary molar distinctly palpable; displaced lingually toward third molar. When third and fourth molars extracted, marked lingual displacement of latter toward other teeth noted. Third molar fully developed: five cusps, and arrangement of fissures corresponding to numeral 6. Roots fused, deep grooves marking fusion line. Apical flexion directed mesially. Fourth molar, in all dimensions, smaller than third; nearly quadrangular occlusal surface; four well-formed cusps. Fissures do not form simple cross, as frequently occurs in four-cusp lower molars, but six grooves in starlike arrangement, starting from small shallow central dimple. Enamel-cementum junction-line runs straight around tooth. Optical cross-section of conical root appears square. Radiograph shows single broad root-canal. Supernumerary tooth, from tip of root to highest cusp, 15 mm. long; third molar, 22 mm. long. Supernumerary tooth, compared with neighbor: dwarfed fully developed lower molar. X-ray examination of other half of jaw: complete absence of supernumerary teeth.

Fully developed fourth mandibular molar one of greatest dental rarities. Only single case of fourth molar in Bolk's vast material. He wrote: "In the molar region the supplementary teeth, at least with our population, are certainly rare. . . . In the literature is always found the case of Langer which then Magitot and other authors illustrated. . . . There is no true supernumerary tooth known, i.e., no fully differentiated fourth molar. What is published under this title, as a rule, is a far reduced or even strange form which does not correspond to the given designation." Stafen, who examined 48,550 individuals, never found fourth mandibular molar. Opinions differ as to importance of fourth molar. Bolk supposes "distomolars," which appear in lengthening of dental row distally from third moler, are reappearing homologues of third molar of Platyrrhinae. Mathis (*J. Den. Res.*, 15: 353, 1936) believes fourth molar may be new acquisition of presumably progressive character in analogy to conditions in Anthropomorpha. Sporadic finding of fourth mandibular molar decides none of questions; new evidence human embryonal dental-bud can develop fourth molar—dwarfed in size but fully formed.

99. SYSTEMATIC PREPARATION OF THIRD-CLASS CAVITIES. *Hermann Wolf, M.D., Dental Institute (Director, Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria.* Preparation of third-class cavities after Black (mesial and distal; front teeth) directly depends (extent), on kind of intended filling material. Two forms: *extended* and *restricted*. For silicate cement, latter advisable—slight resistance to oral debris. Both forms subject to same rules for instrumentation. Work simplified and accelerated with new hatchet-like hand instrument, three edges ("three-cut-hatchet"). *Tabulated instrumentation of third-class cavities:* Following list includes only large forms of respective instruments in Institute's prescribed set. Space lacking: smaller forms, same angles, used.

Outline form: (*a*) To break down labial margin of cavity, hoe 10-4-6. (*b*) To break down lingual margin of cavity, hoe 10-4-12. (*c*) To level gingival wall, hoe 10-4-6. (*d*) To make gingival extension from labio- and linguo-gingival angles, inverted-cone bur 6. (*e*) To obtain gingival extension, hoe 10-4-6; hatchet 10-4-12. (*f*) To finish outline form, inverted-cone bur 8; hoes 10-4-6, 6-2-12; enamel hatchets, 10-6-12 *R*, 10-6-12 *L*. (*g*) To prepare incisal angle, hoe 6-2-6. *Retention form:* Rectangular extension of incisal angle, hoe and hatchet 6-2-12, 6-2-23. Incisal undercut (linguo-labial groove of retention), hatchet 3-2-28. To complete edges and angles between axio-labial and -lin-

gual, and gingival wall of cavity, hoes 6-2-12, 6-2-23; hatchet 6-2-23. *Convenience form:* inverted-cone bur 6. *To remove remaining carious dentin*, spoons 10-6-12 *R*, 10-6-12 *L*. *To finish enamel walls*, hoes 10-4-6, 10-4-12. To make cavo-surface angle, enamel hatchets 10-6-12 *R*, 10-6-12 *L*. *Use of three-cut-hatchet 8-2-23:* (*a*, *b*, *above*) If, at beginning, separation sufficient, three-cut-hatchet insinuated into cavity. By moving hatchet up and down, and simultaneously pulling, labial margin broken down from within; by pressure, lingual margin. (*c*, *d above*) After undermining with cone bur, three-cut-hatchet used labio- and linguo-gingivally; at last incisally. During gingival or incisal work, axis of handle approached far as possible to axis of tooth. Then instrument insinuated from labial and lingual sides. (*Retention, above*) Axio-labial and -lingual inner-edges completed most conveniently with three-cut-hatchet; also useful in work on gingival wall.

C. CONTRIBUTIONS BY OTHER MEMBERS OF THE ASSOCIATION, AND BY GUESTS, WHO COULD NOT BE PRESENT: ABSTRACTS 100–125

100. SURVIVAL OF ARTIFICIALLY INTRODUCED SAPROPHYTES IN MOUTH. I: INFLUENCE OF NUMBER INTRODUCED. *J. L. T. Appleton, B.S., D.D.S., Sc.D., and Anne K. Dietz, Dental School, University of Pennsylvania, Philadelphia, Pa.* Mouths of three persons rinsed with 5 cc. suspensions of *Serratia marcescens* of various concentrations. After periods (0.5 to 14 hrs.) during which nothing taken orally, mouth again rinsed with 2 cc. of diluent and recovery of bacterium from second rinse attempted. Relation between density of suspension and length of survival in mouth, positive; apparently varies with different individuals and in same individual on different days. Mathematical formulation not yet completed.

101. GNATHODYNAMOMETER. *Robert E. Brawley, B.S., D.D.S., M.S., and H. Jobe Sedwick, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Gnathodynamometers classified according to construction. Efforts of previous workers noted. New gnathodynamometer of lever-spring principle described and illustrated.

102. DENTITION AND PALATE OF AUSTRALIAN ABORIGINES. *T. D. Campbell, D.D.Sc., University of Adelaide, South Australia.* (No manuscript for publication.)

103. VINETHENE AS DENTAL ANESTHETIC. *Thomas J. Cook, D.D.S., Hospital, University of Pennsylvania, Philadelphia, Pa.* Vinethene (divinyl ether, $CH_2CHOCHCH_2$) subjected to long series of laboratory tests by Ravdin and associates before administration to human patients. Pure divinyl ether: clear, colorless liquid; sp. gr.,

0.77 C.; b.pt., 28.3 C.; explosive and inflammable; not unpleasant ethereal odor. Author's studies on patients aged from 3 to 60 years. Given by anesthetists familiar with Vinethene, by open drop method. So well tolerated by children that for past five years used exclusively (when available) in extraction of teeth. When carefully administered, satisfactory because without untoward effects on blood pressure or respiration. Rapid induction; even maintenance; excellent relaxation; quick recovery.

104. ACTION OF SODIUM METAPHOSPHATE ON TRICALCIUM PHOSPHATE, DICALCIUM PHOSPHATE, CALCIUM CARBONATE AND HUMAN ENAMEL. *Samuel M. Gordon, Ph.D., Bureau of Chemistry, American Dental Association, Chicago, Ill.* Sodium tetrametaphosphate important ingredient in highly advertised tooth-paste and tooth-powder. Sodium metaphosphates form complex ions which, acting upon insoluble Ca compounds, including human enamel, dissolve Ca. Compounds listed in above title subjected to action of tooth-paste and tooth-powder containing stated compound. Dissolved Ca determined by modification of Clark and Collip method. Amounts of Ca dissolved, from each compound, after correction for blanks, summarized below:

	Enamel	*Tricalcium phosphate*	*Precipitated chalk*	*Calcite*	*Dicalcium phosphate*
Tooth-powder	13.12	14.88	25.62	26.67	26.99
Tooth-paste	9.03	5.24	28.35	19.89	20.53

Normal blood-serum contains approximately 10 mgms. of Ca per 100 cc. Experiments, still in preliminary stage, indicate action on whole human teeth parallels that on powdered human enamel. [*Author's note in proof reading:* Composition of indicated dentifrices lately modified by addition of tricalcium phosphate; decalcifying action of sodium tetrametaphosphate probably thus prevented.]

105. ALVEOLAR ATROPHY IN ANEMIC DOGS. *J. Frank Hall, B.S., D.D.S., and Hamilton B. G. Robinson, M.S., D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* All mouth conditions charted in ten bulldogs and thirteen coach dogs from colony of anemic dogs. Two dead coach dogs and one dead bull dog also available for histological sections. Dogs lived in animal house since birth, 1–13 years, on carefully prepared and balanced

soft diet, although kept anemic by repeated routine extractions of blood. Owing to continual chewing on metal cage and feed pan, anterior teeth in many cases broken and abraded, latter mobile when not in occlusion. Much calculus on practically all posterior teeth; very little abrasion regardless of age. In early stages of alveolar atrophy: hypertrophy and inflammation of soft tissue, with beginning atrophy of osseous structure, followed by extensive atrophy of both alveolus and supporting soft tissue. Microscopic examination: alveolar atrophy and many multinucleated osteoclasts, not proportionately greater in areas of greater resorption. Noted compensatory hypercementosis, followed by root resorption. Animals having been fed on soft food since birth, alveolar atrophy probably due to non-use.

106. DENTAL CARIES AMONG MAYAN INDIANS. *T. J. Hill, D.D.S., F.A.C.D., Dental School, Western Reserve University, Cleveland, Ohio.* Previous report by Steggerda and Hill (*J. Den. Res., 15:* 233, 1936) showed very low incidence of dental caries in teeth of Mayan Indians. Present study attempted to determine prevalence of *B. acidophilus* in same group. Three cultures from each individual studied (180). *Results:* Percentage of Indians free from *B. acidophilus* higher, and number of *B. acidophilus* in individual mouths relatively lower, than in American people.

107. DENTAL RADIOGRAPHIC EXAMINATIONS OF LIVING DOGS. *W. E. Koch, D.D.S., School of Dentistry, Washington University, St. Louis, Mo.* Much past experimental work on animals to demonstrate changes in alveolar bone and dentition owing to dietary and endocrine deficiencies. Radiography heretofore not used to best advantage. Periodic radiodontic examinations on living animals, during experimentation, valuable aid in determining changes in bone and dentition. Systematic procedure and technic essential for accurate interpretation. Dogs used to develop technic embodying definite system of angulation, packet placement and retention, exposure, and assurance of duplication of radiographs for subsequent examination in comparative studies. Fourteen intraoral views constitute complete radiodontic examination for dogs, seven each for maxillary and mandibular regions. Incisor, canine, pre-molar and molar regions radiographed.

108. ADSORBENTS FOR CALCIUM AND PHOSPHATE PARTITION.

Frances Krasnow, Ph.D., and Yetta Porosowska, M.A., Guggenheim Dental Clinic, New York City. Data on differential fractionation of salivary Ca and PO_4 (by adsorption procedures adapted from Klinke, von Beznák, and Benjamin and Hess for blood serum) indicate (*a*) differences of adsorbable portions for caries-free and caries-susceptible individuals. (*b*) Chief difficulty (1932–1937): to obtain standard adsorbent. (*c*) $BaSO_4$ preparations according to Benjamin and Hess yield products extremely variable in percentage of Ca or PO_4, or both, adsorbed from same saliva. (*d*) Non-duplicability of results for $Ca_3(PO_4)_2$ (commonly used adsorbent): whether from same or different sources, preparations markedly unlike in specific gravity and size of salt particles; in percentage volume of water or saliva obtained after centrifugation of thoroughly shaken mixtures; in nature of resulting supernatant fluids; in reaction to litmus from neutral to alkaline, pH 6.65–pH 7.95; in turbidity produced by CO_2, contact with air and CCl_3COOH. *Conclusion:* Corroboration of findings on differential partition of salivary Ca and PO_4, in different laboratories, impossible until supply of standardized adsorbent available. Authors attempting to provide it. (Reported also at meeting of New York Section, Jan. 28, 1937.)

109. COMPARISON OF CRUDE AND REFINED SUGAR AND CEREALS IN ABILITY TO PRODUCE IN VITRO DECALCIFICATION OF TEETH. *T. W. B. Osborn, M.Sc., J. N. Noriskin and J. Staz, University of the Witwatersrand, Johannesburg, South Africa.* Decalcifying power of crude and refined sugars and cereals tested, on sections of teeth, in mixtures of sugar and saliva or cereals and saliva. Decalcification determined by two independent visual examinations; also with sharp probe and by staining with Grenacher borax carmine. In white-sugar mixtures, high percentage of teeth decalcified; in crude-sugar mixture, very few. With whole-mealie meal, very few teeth decalcified; with highly refined flour mixtures, significantly greater proportion. Results indicate presence of "protective agent" in crude sugar and cereals: removed in processes of refining; independent of prevention or reduction of acid fermentation. (Published in *J. Den. Res., 16:* 165, 1937.)

110. FIELD STUDIES ON CARIES PROBLEM IN PRIMITIVE AND MODERNIZED AUSTRALIAN ABORIGINES AND NEW ZEALAND MAORI. *Weston A. Price, D.D.S., M.S., F.A.C.D., Dental Research Laboratories, Cleveland.*

Ohio. Field studies during June–August, 1936, in Australia and New Zealand, to examine environmental factors changed when natives lost high immunity to caries after contact with modern civilization. Factor always present: change from native foods (used according to accumulated wisdom) to foods of modern civilization. Studies included examination of teeth for level of immunity to caries in various groups representing different stages of modernization. More primitive groups in isolated environments in Australia reached by airplane; in New Zealand, under guidance of government official assigned for purpose. Level of immunity to caries among *Bush natives of Australia* ranged from 0 for completely isolated natives to 4.3 teeth per 100 (examined) for natives in *some* contact with modern civilization. Those in *intimate* contact with modern civilization, fed largely by government agencies: 70.9 percent of teeth carious. *Maori of New Zealand:* caries range from 1.7 teeth per 100 (examined) for individuals using mainly native foods, including sea foods, to 55.3 for groups fed in public institution. In Australia and New Zealand native foods consisted of leaves, stems, roots, nuts and berries of land plants; natives in interior also used birds, animal tissues including organs, insects and grubs; those near coast liberally supplemented diet with sea-animal life. Caries rampant among white population of both Australia and New Zealand.

111. FIELD STUDIES ON FACIAL AND DENTAL-ARCH FORM IN PRIMITIVE AND MODERNIZED AUSTRALIAN ABORIGINES AND NEW ZEALAND MAORI. *Weston A. Price, D.D.S., M.S., F.A.C.D., Dental Research Laboratories, Cleveland, Ohio.* Records of shape of head (physical measurements and photographs) and inter-relationship between arches and position of teeth in arches (photographs and extended notes), including examination of many skulls in museums at Sydney, Canberra, and Auckland. For individuals living on native foods (selected according to accumulated wisdom): very high excellence in dental-arch form and regularity of facial pattern. Among children of parents using foods of white civilization, many developed change in facial pattern and shape and interrelation of dental arches. *Australians* raised in Bush, under native conditions: normal dental arches in practically all. Individuals born after parents adopted modern foods: deformed dental arches up to 49.6 percent. *New Zealand:*

factors ranged from 0 for most isolated to 91.2 percent for most highly modernized. Detailed information recorded relative to characteristics of two different dietaries. Samples of native foods collected and brought to laboratory for chemical analysis. Physical conditions among modernized natives similar to those among white civilization.

112. DAILY RHYTHM (16μ) IN RAT INCISOR DEMONSTRATED BY INJECTIONS OF ALIZARINE. *Isaac Schour, B.S., D.D.S., M.S., Ph.D., and M. M. Hoffman, B.S., D.D.S., College of Dentistry, University of Illinois, Chicago, Ill.* Forty-seven white rats, 15 to 302 days old, at intervals given multiple intraperitoneal injections of 0.5 cc. of 2 percent alizarine Red S (sodium sulphalizarate) of color index 1034 (Coleman and Bell Company); killed from 2 to 7 days after last injection. Dosage ranged from 39 to 104 mgms. per kgm. of body weight. Microscopic examination of mid-sagittal, longitudinal and transverse ground sections of incisors showed red line in dentin calcifying at time of each injection. Rate of dentin formation per 24 hours obtained by measuring distance between two successive red lines and dividing by intervening number of days. Total of 330 measurements; each, average of three trials; tangential planes avoided. Average amount of dentin growth per 24 hours, 15.991μ $\pm$ 0.292. *Result:* Same rate of dentin growth of rat incisors as that determined by injections of NaF (Schour and Smith, *J. Am. Den. Assoc.*, 22: 796, 1935). Marshall (*J. Den. Res.*, 3: 241, 1921) reported daily dentin growth of 10μ in rats given injections of alizarine red. Injections of sodium sulphalizarate offer prompt and accurate method of measuring rate of apposition of dentin under normal and experimental conditions.

113. RATE AND GRADIENT OF GROWTH IN HUMAN DECIDUOUS TEETH, WITH SPECIAL REFERENCE TO NEONATAL RING. *Isaac Schour, B.S., D.D.S., M.S., Ph.D., and M. Massler, B.S., College of Dentistry, University of Illinois, Chicago, Ill.* Neonatal ring, in crowns of all human deciduous teeth, demarcates prenatal from postnatal enamel and dentin; provides accurate chronologic landmark for measurements of rate of apposition in crown of human deciduous teeth. Jaws of eight children, teeth showing little or no pathologic disturbance, studied in ground and decalcified sagittal sections. Measured only teeth having actively functional pulps at time of death. Micrometer

measurements: from neonatal ring to pulp, along direction of dentinal tubules, path along which growth occurs. Date of birth of child fixed chronology of neonatal ring; date of death, that of pulp. Measured distance from neonatal ring to pulp divided by age of child in days, after subtracting 14 days to allow for neonatal arrest in growth. (Analysis of jaws of ten children, one hour to 6 months old, showed neonatal *arrest in growth* averages 14 days.) Average rate of apposition in μ per 24 hours of dentin summarized below:

Postnatal rate of growth of dentin of crown of human deciduous teeth measured from neonatal ring; expressed as μ

Deciduous teeth	*Central incisor*	*Lateral incisor*	*Cuspid*	*First molar*	*Second molar*
Incisal or cuspal tip	8	7.5	6.0	5.5	5.5
Middle third of crown	6	5.5	4.5	4.0	4.0
Gingival third of crown	5	4.5			

Gradient of growth conforms with anatomy of tooth. Rate of apposition decreases from incisal or cuspal tip toward gingival portion; also from anterior to posterior teeth. Previous experimental evidence, in lower animals and man, indicates rate of enamel formation approximates that of dentin.

114. GROWTH PATTERN AND CHRONOLOGY OF UPPER DECIDUOUS CENTRAL INCISOR. *Isaac Schour, B.S., D.D.S., M.S., Ph.D., and M. Massler, B.S., College of Dentistry, University of Illinois, Chicago, Ill.* Following factors in tooth-ring analysis paved way for establishment of basic-growth pattern and chronology of upper deciduous central incisor: (*a*) recognition of constant 16-μ calcification rhythm in enamel and dentin; (*b*) discovery of neonatal ring (Schour, *J. Am. Den. Assoc.*, 23: 1946, 1936): (*c*) establishment of characteristic and regular rate and gradient of growth in dentin of crown of human deciduous teeth (abstract 113); and (*d*) experimental demonstration of growth pattern of root of upper central deciduous incisor of child treated with small doses of NaF (Schour and Poncher, *Am. J. Dis. Child.*, 1937). Gradient of growth, in many and minute ramifications, produces particular form and contour of tooth. Further work in progress to analyze growth pattern of other human deciduous and permanent teeth.

115. PALATOMETER. *H. Jobe Sedwick, D.D.S., and Robert E. Brawley, B.S., D.D.S., M.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Methods of measuring hard palate by previous workers indicated. New instrument measuring width, height, and length of palate described and illustrated.

116. MEASUREMENT OF DIMENSIONAL CHANGES IN SILICATE CEMENTS. *Wilmer Souder, Ph.D., F.A.C.D., Principal Physicist and Chief of Dental Research Laboratory, National Bureau of Standards, Washington, D. C.* Measurements of dimensional changes of silicate cements not concordant when made with interferometer, capillary-tube and dye, and mechanical indicator. Tests, using reference plates anchored beneath surfaces of cement rods, showed shrinkage of "expanding" cement though cement immersed in water: suggests so-called expansion of dental cements actually "surface swelling." Spherical (minimum surface) and disk (maximum surface) specimens tested for volume changes, using magnetically damped density-balance. Spheres showed slight early expansions or swellings, 5–25 minutes after specimens made and immersed; shrinkages followed. Disks showed definite expansions or swellings which appeared continuous. (To be published in *J. Am. Den. Assoc.*)

117. ODONTOMES. *Evelyn Sprawson, M.C., D.Sc., L.R.C.P., M.R.C.S., L.D.S., London Hospital Dental School, University of London, London, England.* Origin of term odontome and history of early records. Early human specimen (ca. 1500 B.C.). *Discussion:* Difficulties of definition of classification. Pathology of epithelial odontomes and relation of multilocular cysts of jaw to odontomes. Composite odontomes: pathology of dilated odontomes; classification according to errors in coordination of growth. Connective tissue odontomes. Definition; relation of odontomes to neoplasms and teratomata. (Published in *British Den. J.*, 62: 177, 1937.)

118. TOPICAL ANESTHESIA OF MUCOUS MEMBRANES OF MOUTH. *M. L. Tainter, M.D., A. H. Throndson, D.D.S., and S. M. Moose, D.D.S., F.A.C.D., College of Physicians and Surgeons (Dental School), San Francisco, Calif.* Over 2200 observations on efficacy of anesthetic materials, applied topically to mucosa of mouth in connection with oral surgical procedures, by "blind-test" technique (observer

records effects of anesthetic without having prior knowledge of composition of solution used). Blank control solutions tested to evaluate factors of suggestion, variabilities of response, and errors of interpretation. Aqueous solutions having no anesthetic constituent, colored and flavored to resemble topical anesthetic solutions, 27 percent efficient according to judgment of operators and patients. Alcohol (95%) similarly disguised, 58 percent effective. Acetanilid and benzocaine (each 10%), in ointments of petrolatum, no better than blank controls. Tests included various strengths of following anesthetics, in water or alcohol dilute as possible: tutocaine, metycaine, procaine, cocaine, diothane, "diothane compound solution," phenol, pantocaine, nupercaine, butesin, butyn, "butyn topical solution," larocaine, benzyl alcohol, orthoform, saligenin, benzocaine, menthol, and chlorbutanol. Latter best: chlorbutanol 71 percent as effective as 10 percent solution in 45 percent alcohol. Agents, excepting chlorobutanol, requiring stronger alcohol for solution caused superficial necrosis of epithelium, about one case in five. (Supported in part by grants from California State Dental Association and Research Commission of American Dental Association; to be published in *J. Am. Den. Assoc.*)

119. COMPARATIVE VALUE OF VARIOUS VASOCONSTRICTORS IN LOCAL ANESTHETIC SOLUTIONS. *M. L. Tainter, M.D., A. H. Throndson, D.D.S., and S. M. Moose, D.D.S., F.A.C.D., College of Physicians and Surgeons (Dental School), San Francisco, Calif.* Epinephrine almost universally used as vasoconstrictor in injectable local anesthetic solutions, although little agreement as to optimum concentration, or responsibility for adverse reactions or late toxic effects. Newer synthetic compounds, cobefrin and neosynephrin: have theoretical advantages; in some clinical favor. In unfinished comparative study relative merits of various concentrations, using "blind-test" technique (abstract 118), differences between said three vasoconstrictors less than variations between individual patients. Advantages in one direction offset by disadvantages in another. Ultimate choice largely matter of personal preference. (Supported in part by grants from California State Dental Association and Research Commission of American Dental Association.)

120. COMPARISON OF PROCAINE-HCL AND PROCAINE BORATE (BORO-

CAINE) AS LOCAL ANESTHETICS. *M. L. Tainter, M.D., A. H. Throndson, D.D.S., and S. M. Moose, D.D.S., F.A.C.D., College of Physicians and Surgeons (Dental School), San Francisco, Calif.* Clinical local anesthetic efficiency of solutions of 2 percent procaine-HCl and 4 percent procaine borate (borocaine) compared in 231 extraction cases, using "blind-test" procedure (abstract 118) to eliminate subjective factors. Data analysed statistically to determine reliability of observed differences. None between two solutions in volumes of anesthetic required, times for anesthesia to develop, or duration. Procaine borate produced complete anesthesia in 5 percent more patients than did procaine-HCl; injection painless in 9 percent more. Statistically unreliable indication of slightly less bleeding after procaine borate than after hydrochloride; their effects on blood pressure, and pulse and respiratory rates, practically identical—small average increases in pulse, respiration, and systolic blood pressure, and small fall in diastolic blood pressure. Definitely greater incidence of systemic "reactions" with procaine borate—perspiration, nervousness, tremors and fainting almost twice as often as with hydrochloride. Although at site of injection no differences in pain, or inflammatory reaction, undesirable effects in operative field definitely less with procaine borate. Since solutions of procaine borate must be used fresh (sterilizable only with special precautions and possessing only minor and practically negligible degrees of superiority, but definitely less desirable results in immediate systemic reactions as compared with hydrochloride), procaine borate, at best, no more desirable as local anesthetic than procaine-HCl. Exactly isotonic and alkaline solution of procaine borate not clearly superior to markedly hypotonic and strongly acid solution of procaine-HCl; therefore factors of pH and isotonicity previously emphasized beyond real importance in clinical local anesthesia. (Supported in part by grants from California State Dental Association and Research Commission of American Dental Association. To be published in *J. Am. Den. Assoc.*)

121. NEW GNATHODYNAMOMETER. *P. B. Taylor, A.B., A.M., School of Dentistry, Western Reserve University, Cleveland, Ohio.* Instrument: two metal plates separated by bakelite disc; hole through central portion of latter filled with carbon particles. Electrical resistance of carbon decreases when subjected to pressure. Electrical

leads soldered to edge of each metal disc; instrument connected in electrical circuit—gnathodynamometer, current-indicating instrument, and electromotive source. Thickness of entire assembly less than 4 mm. Permits measurement of biting forces with teeth more nearly in occlusion than heretofore.

122. CHANGES IN ORAL MUCOUS MEMBRANES DURING ACUTE PULMONARY TUBERCULOSIS. *Walter E. Taylor, D.D.S., Reception Hospital, Saranac Lake, N. Y.* Examination of 110 patients (57 male, 53 female): ages 16 to 58; acute pulmonary tuberculosis; each positive sputum and fever of 99°F. or higher, six months or longer; goodly number of adjacent teeth. In 70 (38 male, 32 female), saliva at minimum; oral mucous membranes, dry and glazed, gingivae showing varying degrees of atrophy and resultant exposure of necks of teeth. Remaining 40 (19 males, 21 females): all normal saliva and mucous membranes. No correlation, as yet, of age and systemic condition and gingival change.

123. RETENTION OF REDUCING SUGARS IN SALIVA AFTER MASTICATION OF CARBOHYDRATES. *George W. Teuscher, D.D.S., M.S.D., and Leonard S. Fosdick, Ph.D., Dental School, Northwestern University, Chicago, Ill.* Number of bacteria and retained amount of carbohydrate, in mouth, possible factors in caries. Semiquantitative determination (Benedict solution) of sugar retention, after meals and ingestion of candy (85 boys): gradual disappearance of sugar from saliva after consumption of various sugar-containing foods, rate of removal varying with individuals—those more susceptible to dental caries retained sugar longer. Effect, on mixed saliva, of ingestion of sugary desserts and candy: "larger percentage of sugar remained longer time."

124. EFFECTS OF ORAL HEMOSTATICS ON COAGULATION TIME. *A. H. Throndson, D.D.S., and M. L. Tainter, M.D., College of Physicians and Surgeons (Dental School), San Francisco, Calif.* Study of various drugs advocated for oral use to reduce blood coagulation-time. Six normal subjects measured coagulation-time, by capillary-tube method, once or twice daily two weeks to one month: *control* periods; next two weeks took maximum recommended doses of various hemostatics, continuing measurements; followed by two-week period for *control recovery values*. Results calculated statistically. Prolonged observation periods favored reliable conclusions—thus daily spontane-

ous variations averaged. Administration of gelatine, Styptysate, Fibrogen-Oral, Ceanothyn, and calcium gluconate, separately or combined with large doses of Viosterol: blood coagulation-time not significantly shortened; therefore efficacy, as commonly used preoperatively to diminish anticipated hemorrhage, doubtful.

125. DENTAL OBSERVATIONS AMONG ESKIMO. VII: SURVEY OF MOUTH CONDITIONS, NUTRITIONAL STUDY, AND GNATHODYNAMOMETER DATA, IN MOST PRIMITIVE AND POPULOUS NATIVE VILLAGES IN ALASKA. *L. M. Waugh, D.D.S., F.A.C.D., Dental School, Columbia University, New York City; Dental Consultant, Office of Indian Affairs, and Dental Director (Reserve), U. S. Public Health Service.* During summer of 1936, field study continued in visits to all larger villages along Bering Sea from mouth of Kuskokwim River to Hooper Bay, including Nelson Island. Author accompanied, on cruise, by Dr. Taylor J. Pyle, Supervisor of Dentistry for Alaska, Office of Indian Affairs, who rendered valuable assistance. Under grant from Office of Indian Affairs, U. S. Department of the Interior, Dr. Theodor Rosebury (invited to cooperate) continued in Bethel bacteriologic study begun by Donald B. Waugh previous summer (*J. Den. Res., 15:* 317, 1936). Laboratory again set up (1936) in Bethel, for study of truly primitive natives—nomadic groups in fishing camps in vicinity during June and July [abstracts 21–25]. Author's study of coastal villages facilitated by especially designed, shallow-draft boat he had built and sent there (1935). This visit first ever made in these settlements. Object: (*a*) to extend survey of dental and health conditions prevailing in summer; (*b*) to arrange for housing and maintenance for group of workers for winter of 1937—to complete 12-month nutritional and health study, dietary and living conditions in winter and summer being very different.

Through grant from Office of Indian Affairs, group of four consisting of dentist, physician and field nurse, all of Indian Service stationed in Alaska, and Gies Fellow in Biological Chemistry at Columbia University, accompanied author in February, March and April, 1937.[5] Dietary and nutritional study included qualitative and quanti-

[5] The Research group (1937) consisted of Taylor J. Pyle, D.D.S., Supervisor of Dentistry for Alaska; Otto George, M.D., Akiak, Alaska; Mrs. Florence Hurst, R.N., Bethel, Alaska; Eli H. Siegel, D.D.S., Gies Fellow in Biological Chemistry at Columbia University; and the author.

tative data on food and utilization in each village, tabulated data to be presented in complete report. For summer months, dietary previously reported substantiated. Winter diets, studied on this 1937 expedition for first time, differ extremely from those of summer. Much data obtained corroborating previous findings on dental caries, occlusion, abrasion, alveolar abscess, deposits of calculus, and periclasia. Preliminary records made of eruption periods of permanent teeth. Gnathodynamometer data[6] for molar bites of 151 natives in most primitive villages, registered in lbs.: *Males* (over 14 years)—19 between 200 and 250 lbs.; 34 between 250 and 300; 14 between 300 and 330; 14 over 330; highest 348. *Females* (over 14 years)—12 between 200 and 250; 9 between 250 and 300; 3 over 300; highest 326. (Complete report presented at meeting of American Dental Association, July 1937.)

XII. Necrology[7]

E. B. Fink, p. 356; *Otto Loos*, p. 357; *H. C. Malleson*, p. 357; *C. T. Messner*, p. 357; *R. J. Reade*, p. 358; *B. O. Sippy*, p. 359; *A. E. Webster*, p. 359.

Emanuel B. Fink: 1890–1936

Emanuel B. Fink, Professor of Pathology and Bacteriology at the Chicago College of Dental Surgery, Dental School of Loyola University, died on Monday, June 15, 1936, at his home. He pursued his scientific studies at Rush Medical College where he received the degree of M.D., and at the University of Chicago where he received the degree of Ph.D. in pathology. He was associated with dental problems through teaching and research for the past twelve years. For a number of years he was an active member of the International Association for Dental Research.

Dr. Fink's integrity, keen intellect, and great scholarship won for him the respect and admiration of many students and practitioners

[6] After the author's return, the gnathodynamometer (Brekhus and Armstrong: *J. Den. Res., 15:* 324, 1936) tested for accuracy at the Bureau of Standards in Washington, showed less than 1 percent variation up to 330 lbs.; between 330 and 350 lbs. the variation may be greater. The dial was originally calibrated for 300 lbs.; calibrations to 350 lbs. were added in the field. A dial calibrated for 400 lbs. will be added for future tests.

[7] Second annual report of the Necrology Committee, Frederick B. Noyes, chairman. The report for 1936 was published in the proceedings of the Fourteenth Annual Meeting: *J. Den. Res., 15:* 374, 1936.

who had heard him lecture and teach. Although not a dentist, he was keenly aware of the problems of dentistry and anxious to ally himself with these problems.

OTTO LOOS: 1871–1936

Otto Loos was born on February 16, 1871 and died on April 1 1936. He began his career as a Doctor of Medicine in military service; specialized in oral surgery; became Docent in 1909. After 1914 he was Director of the Dental Institute of the University of Frankfort-on-the-Main, and Professor of Dentistry in the Medical Faculty of the University. His special line of work was oral pathology and pyorrhea, on which subjects he wrote many articles. He was an honorary member of the German Dental Society, active in the Federation Dentaire Internationale, and a member of many other professional organizations.

HERBERT CECIL MALLESON: 1881–1935

Herbert C. Malleson was born on February 27, 1881 and died on November 12, 1935. In 1901, he entered Guy's Hospital, taking his L.D.S. in 1903 and his Conjoint in 1906. He then became Obstetric Resident; later he was awarded the Dental Travelling Scholarship and studied in the University of Pennsylvania. On his return, he joined the staff of the Dental School, on which he remained until his death, when he was Senior Dental Surgeon to the Hospital and had just been elected to the Board of Examiners in Dental Surgery of the Royal College of Surgeons of England. In 1927 he was awarded the John Tomes Prize of the Royal College of Surgeons for his researches into the structure of enamel. He was also part author of a text book on *Practical Dental Histology and Bacteriology*. His degrees were L.R.C.P., M.R.C.S., L.D.S.

A man of extremely genial nature and a loyal friend, Dr. Malleson was greatly beloved by all who knew him.

CLINTON THADDEUS MESSNER: 1885–1936

Clinton Thaddeus Messner, Chief of the Dental Department, United States Public Health Service, died of coronary thrombosis, on May 28, 1936, at his home in Washington, D. C. He was born in

Oxford, Ind., where he attended elementary school, and started dental practice one year after graduation from the dental school of the University of Indiana in 1908. After two years of practice, he went to Portland, Ore., where he taught for two years in the dental college. He then resumed practice in Oxford, continuing there until the United States entered the World War, for which he enlisted, receiving a commission as a lieutenant. In 1919 he was discharged as a lieutenant colonel and then, appointed to the Public Health Service, was assigned to a post in St. Louis. In 1921, he was transferred to Washington, where he remained on active duty until the time of his death. He was a former president of the Association of Military Dental Surgeons; secretary of the Research Commission of the American Dental Association; also a member of the International Association for Dental Research, the New York Academy of Dentistry, the National Board of Dental Examiners, and the American College of Dentists. He helped to establish the first chair of public health ever provided for students at a dental college.

On June 24, 1909, Dr. Messner was married to Edna B. Menfee of Lafayette, Ind. His wife, his mother, a daughter, and a son, survive him. Interment was at Arlington National Cemetery, June 1, 1936.

ROBERT JOHN READE: 1866–1936

Robert J. Reade was born in Toronto, on June 17, 1866, and died on February 20, 1936. He received the degree of D.D.S. from the University of Toronto in 1894; the degree of M.D. from the Trinity Medical College of Toronto. From 1906 until 1908, he was Professor of Medicine in the Royal College of Dental Surgeons of Ontario, which in 1925 became the Faculty of Dentistry, University of Toronto. At the time of his death, he was chairman of the Research Committee of the Canadian Dental Association, and past chairman of the Public Dental Health Committee of the Ontario Dental Association. He was actively associated with the Trinity College Foundation.

For ten years, Dr. Reade was editor of *Dental Practice*. He did considerable research with the ultra-violet ray and its application to dentistry. He was always intensely interested in the progress of dentistry, and his contributions to the advancement of the profession were numerous.

BURNE OLIN SIPPY: 1886–1936

Burne O. Sippy, Professor of Orthodontia at the University of Illinois College of Dentistry, died at the Washington Boulevard Hospital on July 11, 1936. He was born in Ithaca, Wisconsin, on June 16, 1886. His family is well-known in the medical profession: Dr. A. F. Sippy was his father; his uncle, Dr. B. O. Sippy, developed the widely known treatment for ulcers of the stomach; and Dr. Hall Ivan Sippy is his brother. He attended the Buchtel Academy at Akron from 1901 to 1905. He received the degree of Bachelor of Science from the University of Akron in 1909. From 1910–1915 he was a student in the Colleges of Medicine of the University of Michigan and the University of Chicago. In 1915, he was admitted to the College of Dentistry of the University of Illinois, and was granted the degree of Doctor of Dental Surgery in 1915. In 1920, he took the course in the Angle School of Orthodontia in California. In 1926, he was granted the degree of Master of Science by the University of Illinois. He began his teaching at the University of Illinois in 1917. In 1930 he was made Professor in charge of the teaching of undergraduate orthodontia.

Dr. Sippy was Secretary-treasurer of the Chicago Association of Orthodontists from 1927–30, and President of that Organization in 1932. He was Secretary-treasurer of the Odontographic Society of Chicago from 1928–30; President in 1930. He served in many capacities in the Illinois State Dental Society. He was also a member of the Chicago Dental Society and the American Dental Association.

ALBERT EDWARD WEBSTER: 1866–1936

Albert E. Webster died on November 5, 1936, at the age of sixty-nine. In 1893 he received the degree of D.D.S. from the Chicago College of Dental Surgery, which at the time was a department of Lake Forest University; in 1894, the honorary degree of M.D.S. from the Royal College of Dental Surgeons of Ontario; in 1898, the degree of M.D. from Rush Medical College; in 1932 the honorary degree of LL.D. from the University of Toronto. In 1922 he was made a Fellow of the American College of Dentists; in 1932 he received the William Jarvie Fellowship Medal, an award made annually by the dentists of the State of New York for research and

scholastic attainment. In June 1936 he resigned as Professor of Operative Dentistry, Faculty of Dentistry, University of Toronto, after completing forty-three years of service as a dental teacher. He was Demonstrator from 1893 until 1899, when he became Professor of Orthodontia. In 1906 he was made Professor of Operative Dentistry; from 1915 until 1923 he served as Dean, becoming Honorary Dean in 1923. When, in 1925, the School of Dentistry of the Royal College of Dental Surgeons became the Faculty of Dentistry, University of Toronto, Dr. Webster continued to serve as Professor of Operative Dentistry. He was the official representative of Canada at the International Dental Congress at St. Louis in 1904. In 1912 he was a representative of the Canadian Dental Association at the annual meeting of the British Dental Association at Glasgow.

Dr. Webster contributed a number of articles to dental literature; he was editor of the *Dominion Dental Journal* from 1900–35 and author of *A Manual for Dental Assistants*. He was past president of the Canadian Dental Association, the American Institute of Dental Teachers and the International Association for Dental Research. He was honorary member of the British Dental Association, General Dental Association of France, Ontario Dental Association, Toronto East Dental Association, Toronto Academy of Dentistry, Hamilton Academy of Dentistry, and the Dental Nurses' Alumnae Association.

XIII. Executive Proceedings

A. PROPOSED AMENDMENT OF CONSTITUTION

Proposed amendment of constitution: presented at general meeting in 1936, and published in *Proceedings* (*J. Den. Res.*, *15:* 379, 1936); re-published in circular announcement to all members (Jan. 2, 1937); repeated on official ballot. Tellers (Drs. Aisenberg, Chase, Cook) reported amendment received 17 affirmative votes in total of 141 cast—not sufficient for adoption.

B. REPORTS OF OFFICERS AND COMMITTEES

Council, besides reporting routine business, indicated ad-interim appointment of Drs. Merritt, chairman, Eby, Kemple, McKay and Palmer of N. Y. Section as "William J. Gies Endowment Committee for the *Journal of Dental Research*," with power to increase committee (see report, page 361).

Of nominations for membership received by Council, all listed on page 364 (reported as eligible) subsequently elected.

Treasurer's report received and referred, for audit, to committee of members of N. Y. Section. Income exceeded expenditures.

Trustees of Endowment Fund reported Fund now (March 5, 1937) $1,205.72. [Total on March 11, 1936: $1,170.32.]

Secretary, in statement of ad-interim routine proceedings, indicated Dr. W. C. Trotter, of Toronto Section, resigned membership in Association.

Tellers (Drs. Aisenberg, Chase, Cook) reported vote that elected officers listed on page 364; indicated that ballots received from following members:

Aisenberg, Anderson (B. G.), Applebaum, Appleton, Arnim, Austin, Bagnall, Barber, Bear, Bernier, Beube, Beust, Bibby, Bier, Blayney, Blumenthal, Bödecker, Boucher, Brand, Brandhorst, Brashear, Brawley, Brodie, Brown, Bryan, Bryant, Bunting, Carr, Chase, Clark, Clough, Crawford, Crosby, Cushman, Darlington, Dean, Denton, Driak, Eaton, Easton, Eby, Edwards, Erikson, Fleming, Freeman, Friesell (H. E.), Gies, Goodsell, Gordon, Gottlieb, Grossman, Hadley, Hall, Hanzlik, Harvey, Hellman, Hess, Higley, Hill, Hine, Hodge, Hutchinson, Hyatt, Kaplan, Karshan, Kellner, Kelsey, Kesel, Kitchin, Klaffenbach, Korkhaus, Köszeg, Krogh, Krogman, Kronfeld, LeFevre, Leonard, Lewis, Lischer, Little, Manly, Marshall, von Mathe, McBride, McCall, McCrea, McFarland, McKay, Meisel, Merkeley, Merritt, Millberry, Moore, Morse (F. W.), Naprstek, Neumann, Neustadt, Neuwirth, Noyes (H. J.), Oartel, Orban, Paffenbarger, Palazzi, Palmer, Pichler, Pond, Pribyl, Prinz, Rickert, Rule, Salamon, Schour, Schwarz, Sedwick, Skillen, Smith (M. C.), Sorrin, Souder, Sprawson, Stafne, Stephan, Stillman, Swanson, Szabó, Taber, Tainter, Taylor (N. O.), Taylor (W. E.), Thoma, Thomson, Trimble, Van Huysen, Varga, Van Kirk, Waugh, Wheeler, Willett, Willman, Wolf (E. A.), Wolf (H.), Wright (G. H.)—141. [Adopted]

C. JOURNAL OF DENTAL RESEARCH

a. Committee on Endowment

Committee, appointed during current year (p. 360) and designated "The William J. Gies Endowment Committee for the *Journal of Dental Research*," seeks to raise fund to place *Journal* on sound financial basis. Committee's plans include (*a*) solicitation of contributions from individuals and dental organizations, and (*b*) endeavor to increase number of subscribers. Committee purposes to organize coöperative sub-committees in different states. Several organizations already approached, and Committee encouraged to believe substantial support forthcoming. Several contributions already received, also new subscriptions—some as "Sustaining" subscribers at $10.00 per year; some as "Endowment" subscribers at $25.00 annually; some as "Life" subscribers at $100. Work of Committee going

forward satisfactorily.—*Arthur H. Merritt, Chairman.* [Appointment and report approved.][8]

b. Publication Committee

Several circular statements issued by Committee during year presented current financial data and indicated (*a*) Dr. Gies, to give Committee unembarrassed opportunity to formulate plans, continued in financial charge of *Journal* to end of 1936; (*b*) Publication Committee began to coöperate in editorial service on issue for December 1936; and (*c*) issue for February 1937 prepared by Committee with Dr. Gies' coöperation. Committee, under tutelage of Dr. Gies, taught mechanics of editorial duties. Present chief editorial problem: publication of accumulation of 18 manuscripts. Financial conditions improving: $1116.00 received in subscriptions, including sustaining subscribers; *additional*—$600 from American Dental Association through Research Commission; $1000 from New York Academy of Dentistry; $1000 from American College of Dentists; $1000 for advertisements (1937). Committee acknowledges valuable guidance of Dr. Gies, and applauds splendid work of Endowment Committee, just reported by Dr. Merritt. Journal exhibit in lobby supplied by Dr. Schour. Much active assistance received from Drs. Bibby, Brawley, Hall, LeFevre, Manly, McCrea and Sedwick. Dr. McCrea conducting circulation campaign, among I.A.D.R. members, dental faculty members, libraries, study clubs and A.D.A. members. Dr. Hall serving industriously and effectively as advertising manager. Coöperation of many others during year heartily appreciated. "*The Journal of Dental Research is your Journal.* Get behind it and give it all you can."—*Hamilton B. G. Robinson; for Committee.* [Adopted.]

c. Board of Editors

Prior to two sessions of Board at Baltimore, on March 13 and 14, Board, through correspondence conducted by Secretary, voted to recommend to Association that:

"(1) A plan of management of the *Journal of Dental Research* be adopted which would assure the greatest possible freedom from 'political manipulation,' so that the J.D.R.

[8] The Committee has made the following additions to its membership (see report of Council above): Theodor Blum, Frank C. Cole, S. Ellsworth Davenport, W. B. Dunning, C. Fred GaNun, Gordon M. GaNun, Herman J. Kauffer, Joseph H. Kauffmann, Alfred L. Kohn, Richard B. Pomeroy, Theodor Rosebury, J. A. Salzmann, M. C. Tracy, Leuman M. Waugh, and Maurice William.

will remain primarily and notably representative of the best in science. (2) This plan of management, under the general jurisdiction of the Association, should include a (*a*) Board of Editors representing, as at present, *all* sections of the I.A.D.R. [one per section] to act for the Association on all J.D.R. matters of broad policy; and to designate the official positions of, and to elect, a (*b*) small group (3 to 5) in any section (Rochester group, for example), or otherwise, as the *active* editorial and managerial staff; the (*c*) said 'small group' to appoint assistants and to proceed as the executive committee (as in the case of the present Publication Committee). (3) Without diminishing attention to present responsibilities relating to the J.D.R., the Association should again *explore the possibility* of inducing the American Dental Association, the American College of Dentists, or another competent organization, to conduct the J.D.R. on a plan that the I.A.D.R. could endorse and support."

At meeting on Mar. 14, Board voted to confirm above recommendations, with following further recommendations for clarification and amplification of plan developed as indicated:

(4) In view of splendid work of Publication Committee appointed at annual meeting in Louisville (Mar. 1936), and as expression of full confidence in Committee, recommended that J. F. Hall, M. K. Hine, H. C. Hodge, M. W. McCrea, and H. B. G. Robinson be chosen Publication Committee of *Journal*, from March 15, 1937 to March 15, 1938, and placed in full charge of editorial and financial management of J.D.R., subject to jurisdiction of Board of Editors of I.A.D.R., as designated and defined in section 2, above.

(5) Publication Committee named above should be empowered to appoint assistants, and proceed as Executive Committee of Board of Editors, as recommended in section 2, c, above.

(6) Publication Committee should be empowered to explore and, within framework of Board's expressed wishes, to utilize all possibilities for financial aid to J.D.R. from dental or other competent organizations by plan which I.A.D.R. could endorse and support.

(7) In order that books, accounts, and funds of J.D.R. may be audited, auditing committee of three should be appointed by President with advice of Secretary in usual way.—*Edward H. Hatton, chairman.* [Adopted.]

D. MISCELLANEOUS TRANSACTIONS

Incorporation. Secretary authorized to select associates to serve as committee to consider problems relating to prospective incorporation of *Journal* or Association.

Resolutions of appreciation. Secretary instructed to express, to management of Hotel Baltimore, to Baltimore Section and to Dr. Aisenberg, chairman of the local-arrangements committee, Association's appreciation

of hospitality and of coöperation accorded to Association in general and to members individually.

E. LIST OF OFFICERS, AND NEW MEMBERS, ELECTED

a. Officers (1937–38)

HONORARY: *Vice-presidents*—JÓZSEF SZABÓ, Budapest. ASHLEY W. LINDSAY, Chengtu. J. C. MIDDLETON SHAW, Johannesburg. JOSEPH L. PAYNE, London. KAREL WACHSMANN, SR., Prague. OTTO HOFER, Vienna.

ACTIVE: *President*—PAUL C. KITCHIN, Ohio State University. *President-elect*—THOMAS J. HILL, Western Reserve University. *Vice-president*—RUDOLF KRONFELD, Loyola University (Chicago). *Treasurer*—BISSELL B. PALMER, N. Y. Polyclinic Medical School and Hospital. *Secretary*—WILLIAM J. GIES, Columbia University. *Trustee of the Endowment Fund* (three years)—RUSSELL W. BUNTING, University of Michigan.

b. New members[9]

Ann Arbor, Mich. FLOYD A. PEYTON, A.B., M.Sc., D.Sc., Instr. in Dental Metallurgy, Dental School, Univ. of Michigan.

Boston, Mass. HOWARD M. MARJERISON, D.M.D., Dean, Dental School, Tufts College.

Buffalo, N. Y. MATHEW PODOLIN, D.D.S., M.S.D., 560 Delaware Ave.

Chicago, Ill. ROLAND S. CLAFLIN, D.D.S., M.D.S., and RUTH TUNNICLIFF, A.B., M.D., Research workers, Foundation for Dental Research, Chicago College of Dental Surgery (Loyola Univ.). EDWARD C. WACH, Ph.G., D.D.S., Assoc. in Materia Medica and Dental Therapeutics, Dental School, Univ. of Illinois. EARL A. ZAUS, B.S., M.D., Assoc. Prof. of Physiology and Pharmacology, Dental School, Northwestern Univ.

Czechoslovakia, Prague. KARL HAÜPL, M.D., Director of the Dental Clinic, German Univ.

Detroit, Mich. CHARLES LANE, D.D.S., F.A.C.D., Dean, School of Dentistry, Univ. of Detroit.

Korea, Seoul. JOHN L. BOOTS, B.S., M.S., D.D.S., F.A.C.D., Prof. of Dentistry, Severance Union Medical College.

New Haven, Conn. LESTER W. BURKET, B.A., D.D.S., M.D., Instr. in Dental Pathology, School of Medicine, Yale Univ.

[9] A list of the members, as of December 1, 1936, was published in the *J. Den. Res.*, *15:* 462, 1936. A list of the members elected in 1936 was published in the *J. Den. Res.*, *15:* 380, 1936.

New Orleans, La. SIDNEY L. TIBLIER, B.A., M.S., D.D.S., Prof. of Radiology and Oral Pathology, Loyola Univ. CHARLES S. TULLER, D.D.S., 729 Maison Blanche. FREDERICK J. WOLFE, D.D.S., 835 Maison Blanche.

New York, N. Y. RALPH H. BRODSKY, D.M.D., Director, Division of Oral Surgery, Sea View Hosp. RAYMOND GETTINGER, B.S., M.D., Pathologist and Director of Laboratory, and THEODORE KALETSKY, D.D.S., President, New York Inst. of Clinical Oral Pathology. SAMUEL HEMLEY, D.D.S., Assoc. Prof. of Orthodontia, and IRVING SALMAN, D.D.S., Asst. Prof. of Oral Surgery, Dental School, New York Univ. WILLIAM LEFKOWITZ, D.D.S., Instr. in Oral Histology, Dental School, Columbia Univ.

Philadelphia, Pa. WALTER S. CROWELL, B.S. in Ch.E., Chemical Engineer, Research Dept., S. S. White Dental Manufacturing Co.

Pittsburgh, Pa. W. HARRY ARCHER, D.D.S., Instr. and Lect. in Anesthesia and Exodontia, Dental School, and GERALD J. COX, B.S., M.S., Ph.D., Senior Fellow, Mellon Institute, Univ. of Pittsburgh.

Richmond, Va. WEBB B. GURLEY, D.D.S., Asst. Prof. and Head of Department of Operative Dentistry and Oral Anatomy, Dental School, Medical College of Virginia.

Rochester, N. Y. VIRGIL D. CHEYNE, D.D.S., Carnegie Fellow in Dentistry, School of Medicine and Dentistry, Univ. of Rochester.

Total number of new members, 25.

Total active membership (June 30, 1937), 439.

F. MEMBERS PRESENT AT ONE OR MORE SESSIONS

SECTIONS. *Ann Arbor:* Bunting, Jay, Peyton, Rickert, Ward. *Baltimore:* Aisenberg, Anderson, Dobbs, Goldstein, Kelsey, McCollum, Robinson. *Boston:* Boyle, Cushman, Marjerison, Miner, Morse (A. L.), Trimble. *Chicago:* Black, Blayney, Freeman, Hatton, Kronfeld, Logan, Noyes (F. B.), Noyes (H. J.), Nylander, Skillen, Tunnicliff. *Cleveland:* Chase. *Columbus:* Boucher, Edwards, Kitchin, Semans. *Iowa City:* Bryan. *Louisville:* Beust, O'Rourke. *Minnesota:* Brekhus, Taylor. *New Haven:* Burket, Burn. *New York:* Beube, Bödecker, Crawford, Darlington, Dunning, Gies, Hemley, Hirschfeld, Karshan, Lefkowitz, Leonard, McBeath, Merritt, Neuwirth, Rosebury, Sorrin. *Philadelphia:* Appleton, Cook, Crowell, Grossman. *Pittsburgh:* Cox, McBride, Oartel, Swanson, Van Kirk, Wolf. *Richmond:* Bear, Clough, Gurley, Hall, Little, Lyons, Van Huysen. *Rochester:* Bibby, Cheyne, Hodge, LeFevre, Manly, McCrea, Robinson. *St. Louis:* Lischer. *San Francisco:* Fleming. *Washington:* Barber, Crane, Erikson, Kaplan, Krogh, Paffenbarger, Schoonover, Sweeney. *No Section:* Brashear (New Orleans); Gillett (New York); Isaacs (Milford, Del.); Klein (Washington). *Total*—95. [All U. S. sections represented in attendance.]